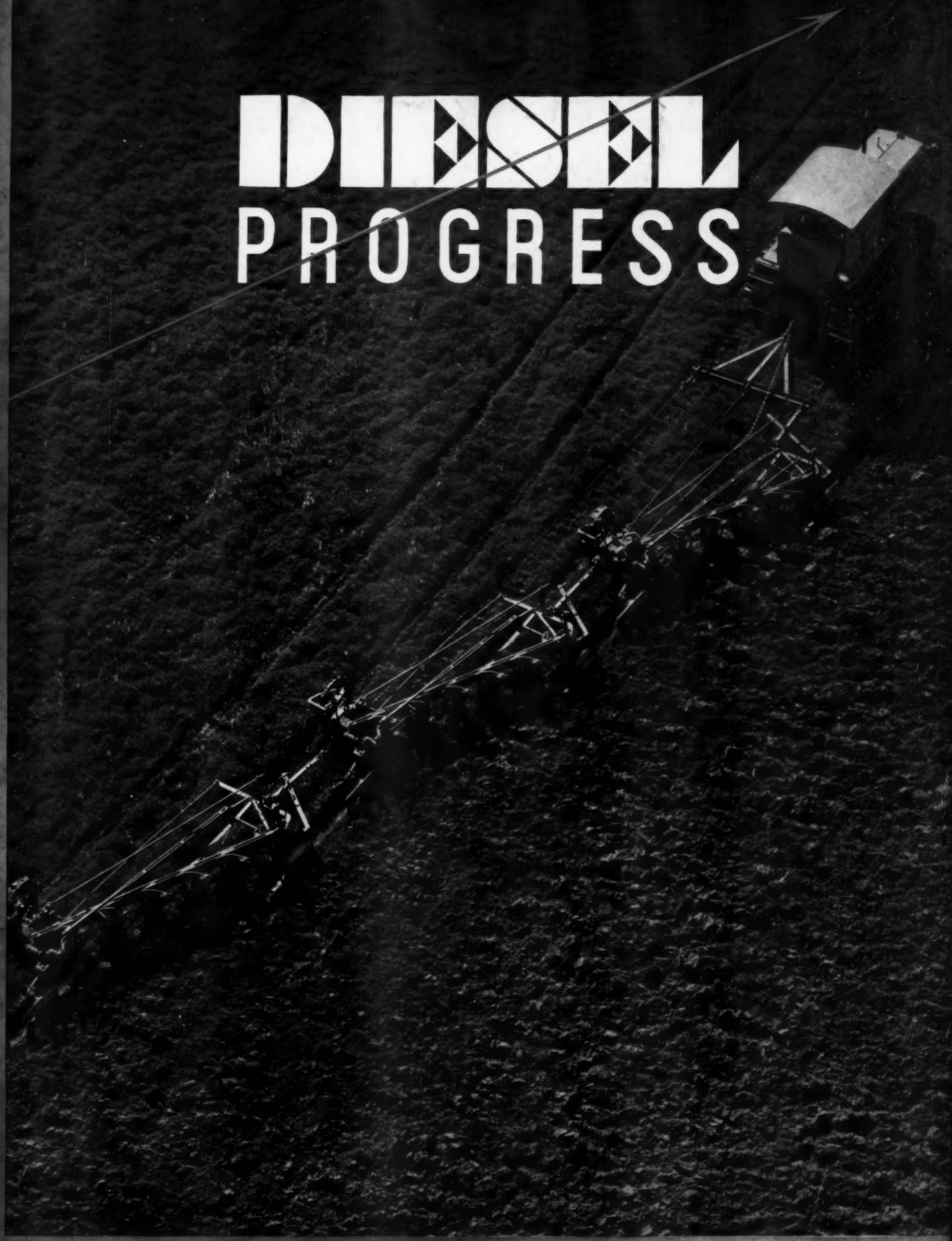
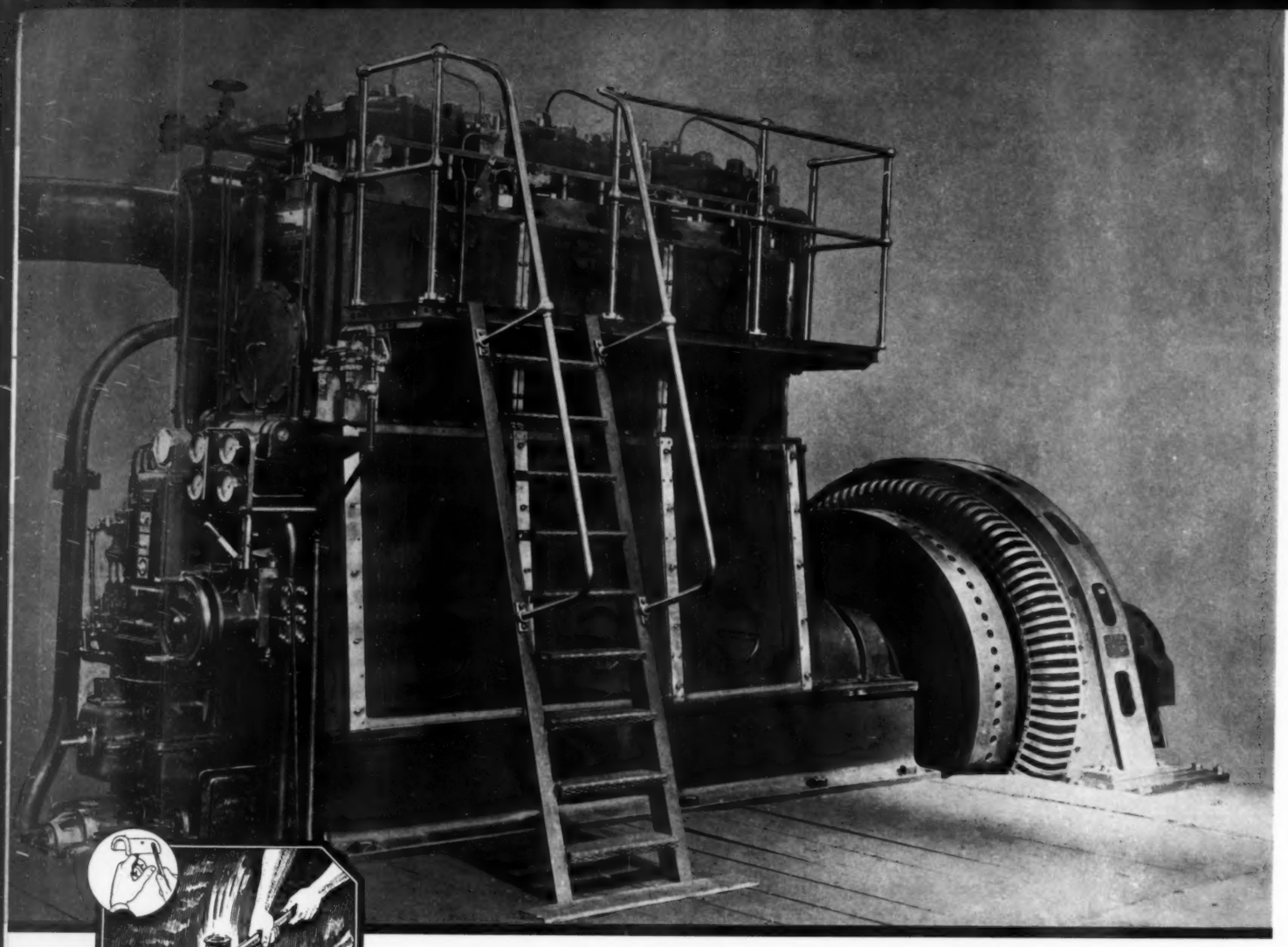
DIESEL PROGRESS

IN INDUSTRY • IN TRANSPORTATION • ON THE SEA • IN THE AIR



APRIL, 1936 CIRCULATION OF THIS ISSUE—IN EXCESS OF 10,000 COPIES 25c

DIESEL PROGRESS for April, 1936. Volume II, No. 4. DIESEL PROGRESS is published monthly by Diesel Engines, Inc., 2 West Forty-fifth Street, New York, N. Y. Rex W. Wadman, President. Acceptance under the Act of June 5, 1934, at Brooklyn, New York, authorized May 14, 1935. Subscription rates: United States and Pan American countries $3.00, Canada and all other countries $5.00 per year. Single copy price 25 cents in U.S.A., 50 cents for all other countries.



Three single-acting, trunk piston, two-cycle HAMILTON - M.A.N. Diesel engines, 21½" x 27½", 240 rpm. 750 kw. Built by HOOVEN, OWENS, RENTSCHLER CO., Hamilton, Ohio, for the Imperial Irrigation District of California for installation in their Brawley plant. These engines are equipped with Satco* bearings.

DAILY the Diesel engine gives a convincing demonstration of its versatility. Afloat and ashore, Diesel installations increase in number as proof of the Diesel's economical performance becomes more widely known.

Here we see a ship sailing the high seas; there we find a tractor battling through a swamp; on the highways, heavy trucks carrying heavier payloads; on the rails, swift new trains giving the traveling public a new deal — all powered by Diesel engines.

It has been the job of American Bearing Corporation to help insure steady, trouble-free operation of Diesel engines in many varied fields, by designing and fabricating the several types of bearings required.

Our bearings of Satco* metal are of special interest to builders and operators of Diesel engines. Satco* possesses all the important requisites of a modern bearing metal: adequate resistance to crushing stresses; a low frictional coefficient; a relatively high melting point; resistance to extraordinary deformation; ability to adapt itself to the ordinary play of the shaft.

We invite your inquiries on all matters pertaining to bearings

*A patented alloy manufactured by National Lead Company
Trademark Registered

AMERICAN BEARING CORPORATION

Affiliated with National Lead Company

INDIANAPOLIS CENTRIFUGAL American Bearings FORCE **INDIANA**

130,000 *Miles* OF TOUGH HAULING

...and the engine is still like new

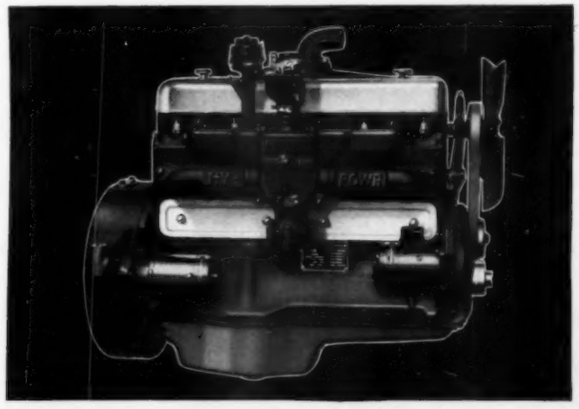
Ted Dyer of Spokane, operates the Overland Freightways, an interstate trucking business. Here's one of his trucks . . . a Studebaker Big Chief Tractor powered by a 6-110 Waukesha Hy-Powr Engine, 4 x 4¾, 106-110 hp.

The truck runs regularly between Spokane, Wash. and Portland, Ore., 400 miles one way, over the famous Columbia River Hi-way. The average load is 10 tons on a single axle semi-trailer.

Mr. Dyer says, "The first 90 miles out of Portland is about the most grueling test the year around that you could put a truck over in hiway transportation work. I have put 130,000 miles on the job and I can't even rebore the engine, 'it just can't take it' as the cylinders were out only six thousandths of an inch, not enough to bother with. So we just put in the second set of rings and rolled her down the road."

This engine has the Hy-Powr combustion chamber . . . *exclusively Waukesha.* It increases power 20 to 30% . . . with an equal saving in weight and size. Cooling is improved . . . valves and seats last longer. The engine runs smoother. Fuel consumption is reduced.

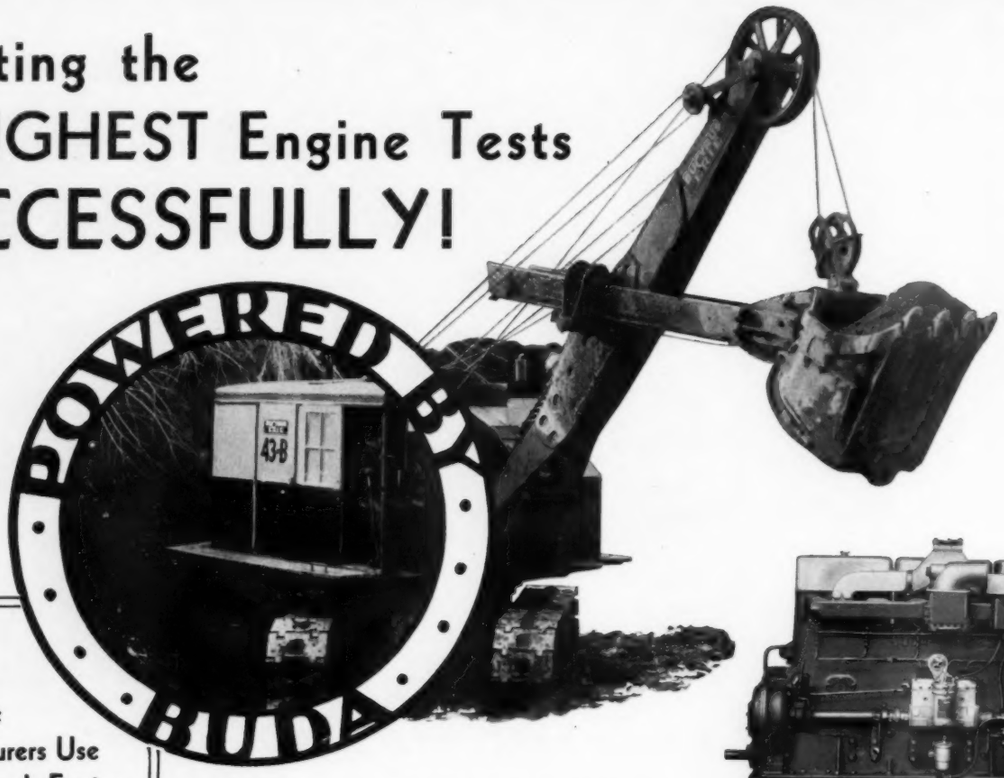
Write for Bulletin 888. *Waukesha Motor Company, Waukesha, Wisconsin.*

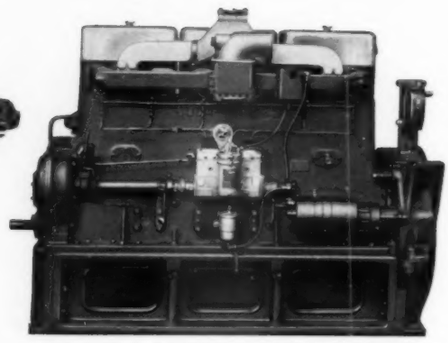


The Waukesha 6-110-358 Hy-Powr Engine under the hood of Mr. Dyer's Studebaker Big Chief.

WAUKESHA ENGINES

Meeting the TOUGHEST Engine Tests SUCCESSFULLY!





Buda Diesel Model 6D 1742

These Shovel and Crane Manufacturers Use Buda Diesel Engines

American Hoist & Derrick
Bay City Shovels, Inc.
Browning Crane & Shovel Co.
Bucyrus-Erie Company
Byers Machine Co.
General Excavator Co.
Harnischfeger Corporation
Industrial Brownhoist Corporation
Koehring Company
Lima Locomotive Works
Link Belt Company
Marion Steam Shovel Company
Orton Crane & Shovel Co.
The Osgood Company
Thew Shovel Company

SHOVEL operation is the toughest test that can be put on any engine. To be successful in this service a power plant must be able to operate on any load or no load for an indefinite period, change from no load to peak load instantly and meet the heavy drag down loads that are encountered by the sudden contact of the dipper with rock or shale.

Buda Diesel Engines are meeting the conditions of shovel crane and dragline service as is evidenced by the fact that every important shovel manufacturer is using them and in many cases is standardizing on them.

Perhaps your service isn't so rigorous but whatever it is you can rest assured that Buda Diesel Engines have the stamina and operating characteristics that will meet it.

Mine Locomotive

BUDA DIESELS Are Standard on These Products

Locomotives
Generating Sets
Feed Grinders
Hoists
Pavers
Refrigerators
Injection Pumps
Crushers
Sweepers
Well Drilling Equipment
Shovels
Cranes
Compressors
Dredges
Busses
Oil Field Pipe Line Equipment
Logging Equipment
Boats
Trucks
Rollers

H. P. from 32 to 180

THE BUDA COMPANY

Industrial Division K

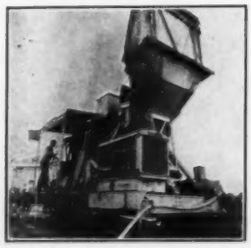
HARVEY (CHICAGO SUBURB) ILLINOIS

BUDA ENGINES

Hoist

Stationary Compressor

Paver



Road Roller

Pipe Line Pumping

Portable Compressor

Lighting Plant

EN·AR·CO

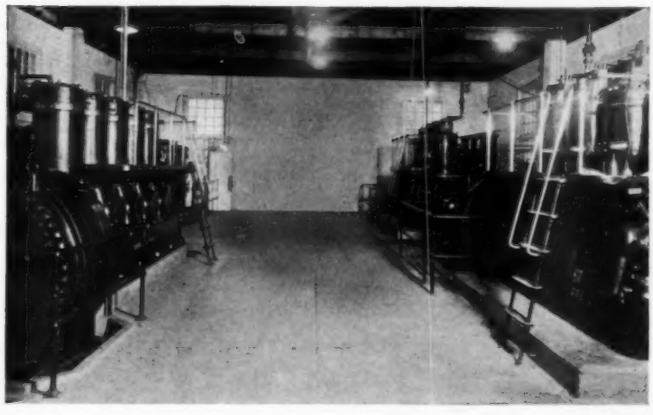
DIESEL OILS FOR ECONOMY

• In every type of operation, it's actual performance in YOUR OWN EQUIPMENT that counts!

• The extra hours of service in the crankcase and hours saved by the avoidance of shutdowns will convince you that En-ar-co Diesel Oils are more economical.

• Users of En-ar-co know these facts, of course they do, and their evidence is convincing testimony but the best way to determine what these savings can mean to you is to test En-ar-co in your plant.

• Weigh its performance from every angle and judge for yourself.



• The Superintendent of a leading contracting concern says, "We have been using En-ar-co in our Diesel equipment and can truthfully say it's the best we have found. Our experience with Diesel equipment has given us an opportunity to test the oils of various companies and we find that no other oil has given us as satisfactory results. We operate a fleet of 75 H.P. Caterpillar Tractors and a fleet of Euclid Trac-Trucks and the conditions under which they operate are very severe."

The Superintendent of the Diesel powered light plant at the left says, "We have been using En-ar-co Diesel Oils in our Fairbanks-Morse engines for the past five years. The oil has given perfect satisfaction."

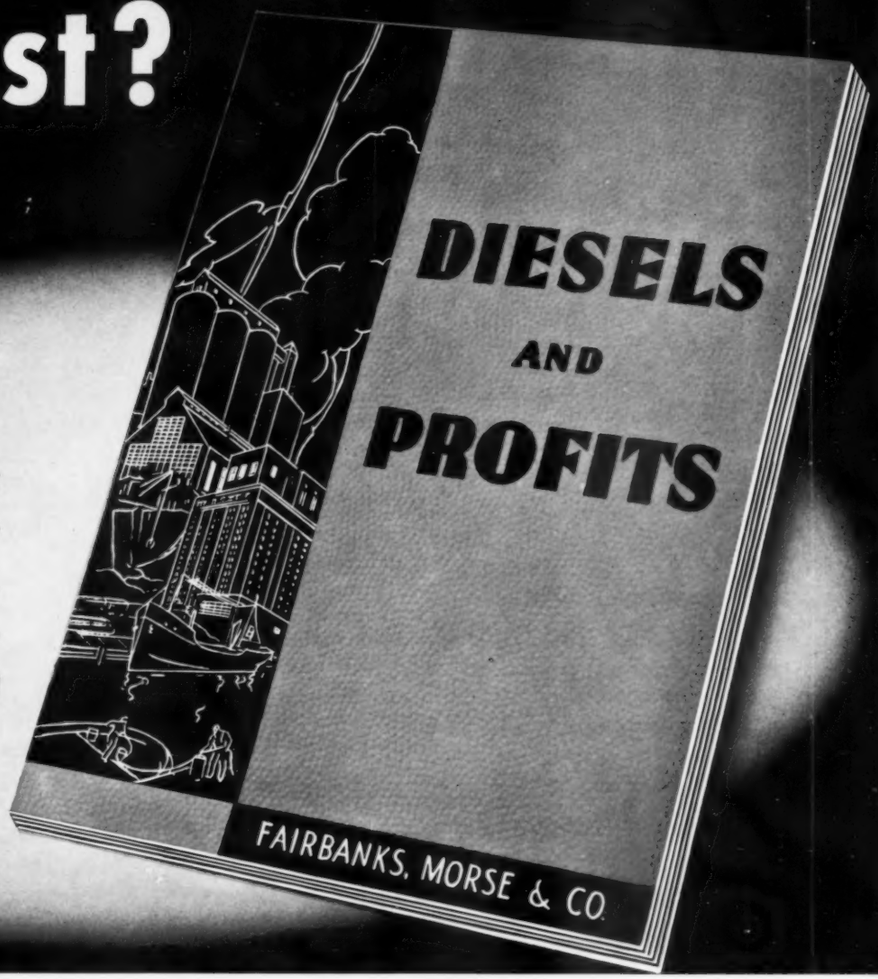
THE NATIONAL REFINING COMPANY

HANNA BLDG. CLEVELAND, OHIO

QUALITY

How Much Should YOUR Power Cost?

. . . . This interesting book tells in simple language how Diesels supply power at exceedingly low cost for every industrial and municipal requirement



WHETHER or not you consider your present power costs high . . . whether or not your present power source is dependable and economical . . . you owe it to yourself to become at least acquainted with what Diesel power in one of its many forms can do for your business.

Our book *Diesels and Profits* is a simple presentation outlining what Diesels are. How they work. How they are used in industry. How they are able to slash costs by their ability to produce power cheaply and dependably.

Behind this book lies a rich experience reflected in three million horsepower of F-M Diesels in industrial, municipal, shipping, transportation, and a dozen other fields. Your copy will be sent without obligation. Address Department G-81, Fairbanks, Morse & Co., 900 S. Wabash Avenue, Chicago, Ill. 34 branches at your service throughout the United States.

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106 YEARS OF PRECISION MANUFACTURING

FAIRBANKS-MORSE

Diesel Engines

POWER, PUMPING AND WEIGHING EQUIPMENT

Ahead of the Parade

SINCE 1932, when Sterling pioneered Diesel power for motor trucks, Sterling-Diesels have been AHEAD OF THE PARADE with tremendously reduced ton-mile costs and superior truck performance. Here are some of the reasons why Sterling-Diesels are the leaders in the heavy-duty truck field today—

FUEL COSTS REDUCED as much as 75%! This is due to low cost of fuel and to double the miles per gallon. Operators, hauling 20 to 25 tons, consistently report fuel costs of 1c a mile and less.

TIME SAVINGS on road of as much as 33⅓%! Diesel torque characteristics result in less gear shifting on grades and also higher road speeds on heavy pulls.

LOWER OPERATING COSTS—Because of Diesel engine simplicity, minimum gear shifting, greater power, wood-lined frames, and correct design, there is less time and money needed for maintenance.

LONG LIFE—Sterling-Diesel owners are getting a truck life of more than ½ million miles. Many are approaching the 1,000,000 mile mark!

DIESEL CONSTRUCTION—When you buy a Sterling-Diesel, you buy a truck that is specifically engineered for Diesel power and made to fit your particular operating conditions.

PROVEN MANUFACTURING METHODS—For twenty-nine years Sterling has been producing the best motor trucks that can be built.

PROOF—There is no better proof of Sterling-Diesel superiority than the re-orders from owners. One fleet of over fifty units has been built up by a steady re-order policy of replacing old equipment with new Sterling-Diesels. Another owner who purchased his first Sterling-Diesel three years ago now has eighteen in his fleet. Sterling-Diesels SELL THEMSELVES because of superior performance and low-cost operation.

Quality All-Purpose Trucks
Dump and Commercial Chassis
4 and 6 Wheel—2 to 30 ton capacity

Sterling

CHAIN DRIVE

Successful truck operators buy Sterling chain drive trucks because they stand the "gaff" and render unfailing service for a longer period of time at a lower cost per ton-mile. Chain drive construction makes possible maximum axle clearance, lightest chassis weight, therefore, largest pay-loads. It is the most direct means of power application and due to sprocket reduction, drive gear strains are less.

DOUBLE REDUCTION

Sturdily built for heavy duty service, incorporating all modern designs and methods of manufacture. Gears are spiral bevel and herringbone, assuring maximum quietness and long life. The patented differential automatically compensates for the loss of traction of one driving wheel by transmitting additional power to the other driving wheel having power.

BEVEL GEAR

A single reduction drive, ideal for speedy transportation. The pinion shaft is supported by three bearings and the differential by heavy duty Timken bearings. To prevent gear deflection under shock loads, a bronze thrust block is provided. These features prevent change in tooth contact, keep the bevel gear and pinion firmly in their correct positions, thus preventing breaking of gear teeth.

STERLING MOTOR TRUCK CO., Inc.

MILWAUKEE, WISCONSIN

DISTRIBUTED BY STERLING MOTORS CORPORATION AND DEALERS IN PRINCIPAL CITIES

Freeport Power Plant—Over 11,000 BHP of Busch-Sulzer Diesels

Freeport Has Bought from Busch-Sulzer 8 Times in 16 Years

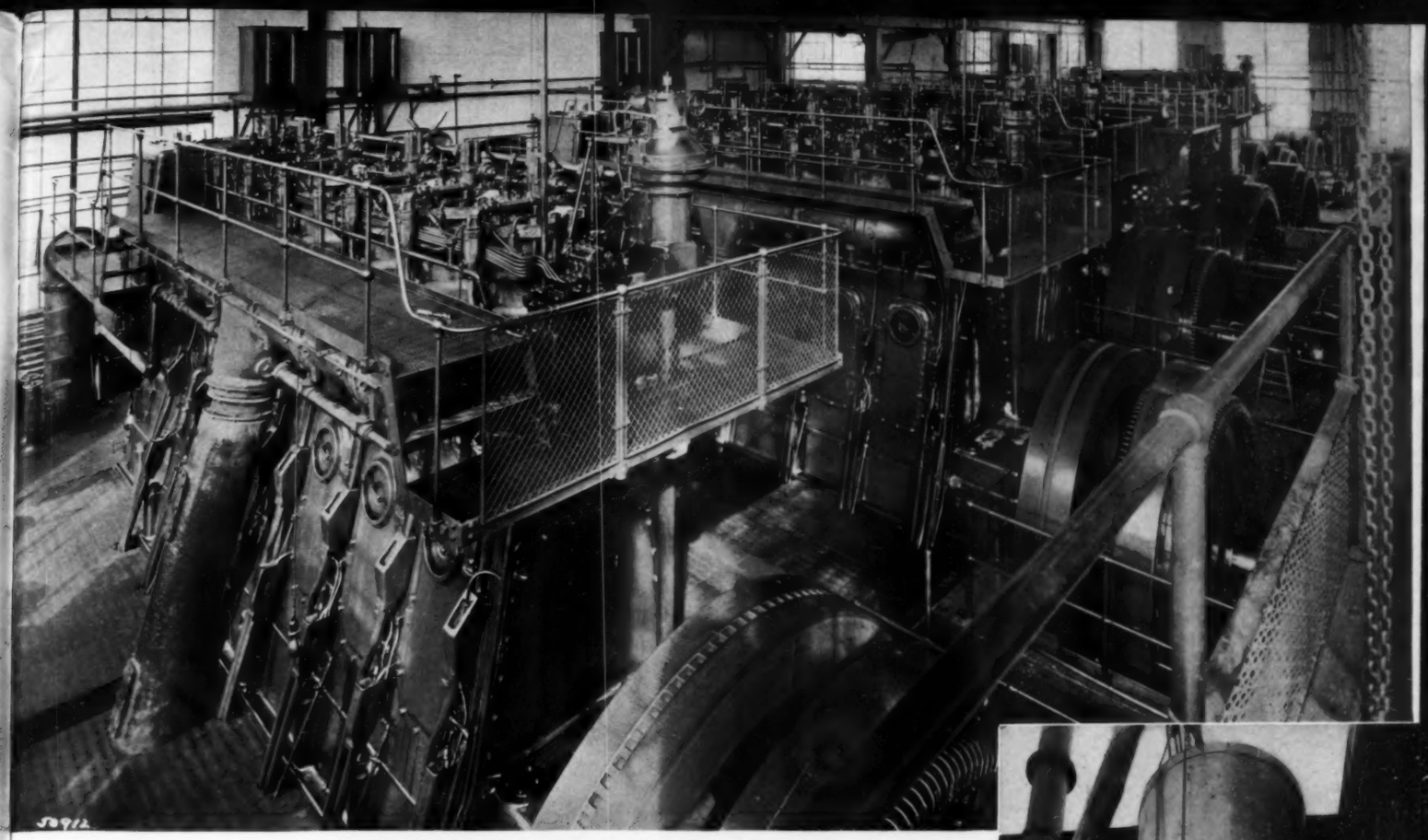
- **Due to unusual local conditions the electrical load at Freeport has enjoyed a growth more rapid than normal.**

- **Since the installation of their first Diesel, a 365 BHP Busch-Sulzer in 1920, Freeport has found it necessary to increase their capacity 7 times. Each time another Busch-Sulzer was selected and their present plant, 11,300 BHP, is the largest Diesel generating station on the eastern seaboard.**

- **The original Busch-Sulzer Diesel was removed in 1935 to make room for the latest 3,000 BHP unit and has been reinstalled in another plant. This 15-year-old Diesel is expected to give many more years of reliable service.**

BUSCH-SULZER

BUSCH-SULZER BROS.-DIESEL ENGINE CO. . . . ST. LOUIS



Freeport, Long Island, municipal plant showing recent VORTEX installation.

VORTEX

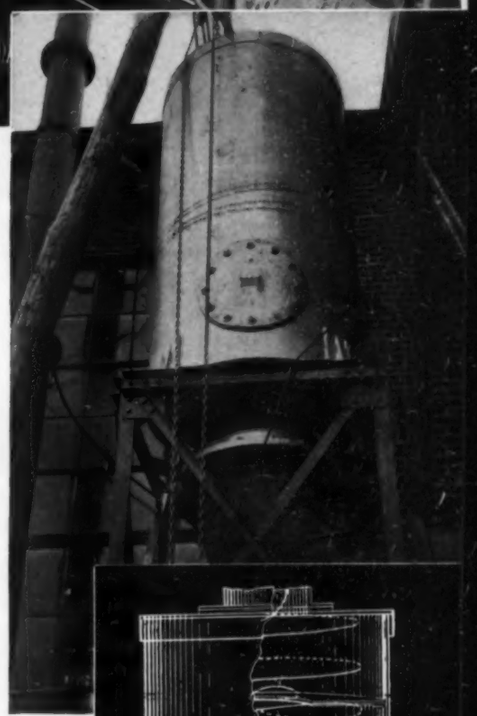
adds SAFETY to Diesel Engine Silencing

IN addition to positive elimination of Diesel exhaust noise and vibration, the Vortex silencer and spark arrester provides thorough protection from fire and legal action resulting from fire caused by exhaust sparks and glowing carbon.

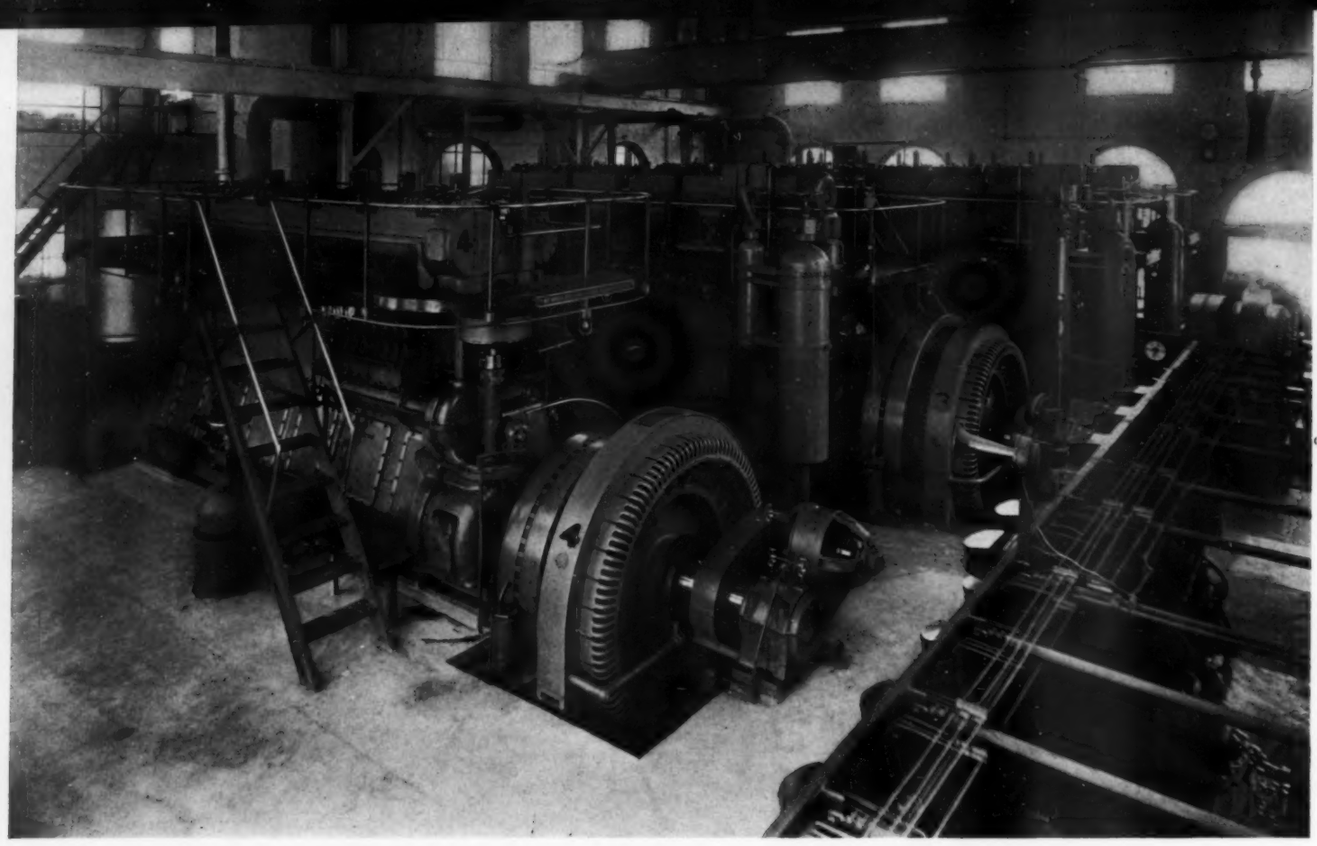
The Vortex action of the exhaust gases plus their rapid expansion effectively dampens all pulsations to a point where noise and panting are negligible. Extraction of sparks and carbon particles is 100% efficient for diameters of one thousandth of an inch and larger, thus fire from live exhaust sparks is impossible.

Since Vortex silencers operate dry and are self-cleaning, corrosion and maintenance are reduced to a minimum. Back pressure, likewise, is as low as possible consistent with proper silencing.

Vortex offers the Diesel owner a silencer and spark arrester simple in design, rugged in construction and positive in operation, specifically engineered for each specific installation. More than 300 Vortex Diesel installations guarantee quiet operation with no fire risk from exhaust sparks.



ENGINEERING SPECIALTIES, Inc.
39 Cortlandt St. New York City



CRANKSHAFTS

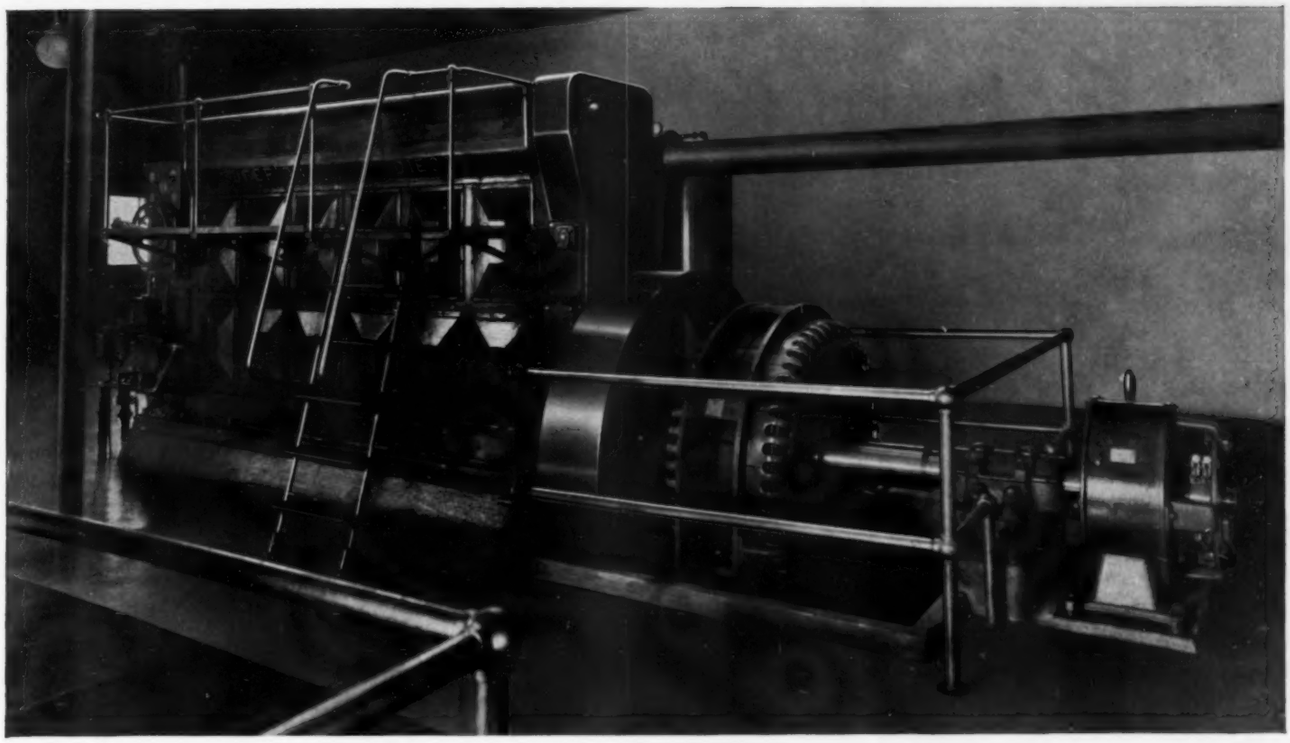
Again the selection of ERIE crankshafts was made for the two eight cylinder and two six cylinder Diesel engines built by McIntosh & Seymour Corporation for the HUDSON, MASS., municipal plant.

Because of their superior quality and accurate finish leading engine builders rely upon ERIE crankshafts and other forged parts entering into the construction of stationary and marine engines.

Rough and finished connecting rods, piston rods, crossheads, generator and extension shafts for all classes of stationary and marine engines. Complete facilities for prompt delivery on all major forged or cast steel elements required in the building and powering of every type of construction.

ERIE FORGE COMPANY

ERIE, PENNSYLVANIA



MUNICIPAL POWER SERVICE . . .

. . . power for hospitals, water supply, fire protection, homes, office buildings and industrial plants . . . MUST NOT FAIL.

The City Officials of Plainview, Nebraska, selected a 6 cylinder, 12½ x 15, 380 H. P. Superior Diesel for the latest addition to their Municipal Power Plant.

Superior's modern design and rugged construction gave them every assurance of the reliability so essential in this important service.

Industrial power users desiring this same quality of dependability in their power equipment will find it in the Superior line. Horsepowers range from 25 to 900 in 2 to 8 cylinder models . . . a complete line available for main power or standby service.

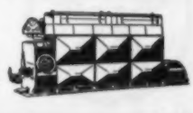
Write for Bulletin DPA-535

Superior DIESELS

25 to 150 H. P.

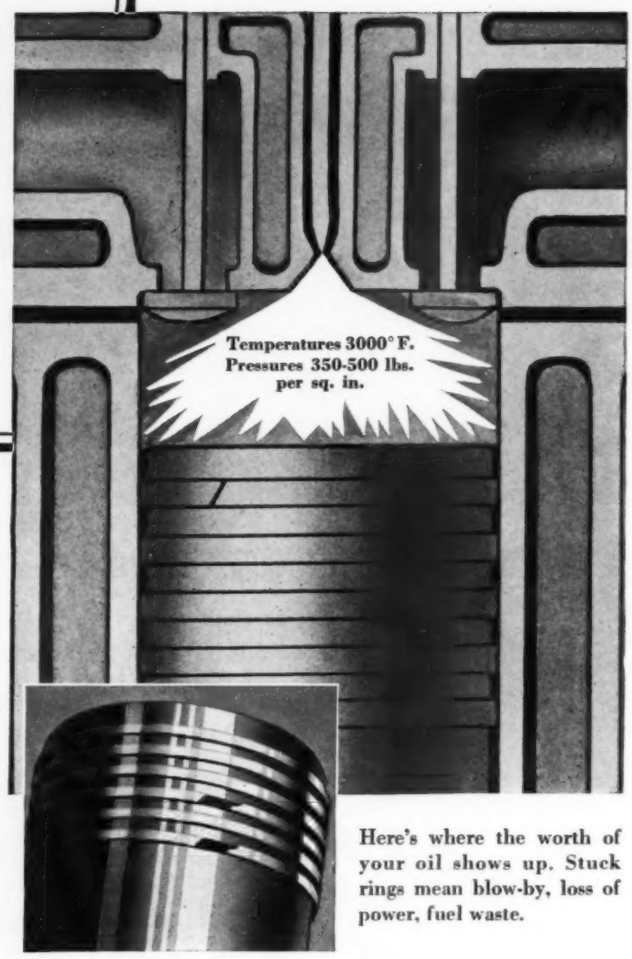
THE
NATIONAL - SUPERIOR
COMPANY
SPRINGFIELD, O. . . . LOS ANGELES, CAL.

50 to 900 H. P.



THE OTTO ENGINE WORKS . . . . PHILADELPHIA, PA.

Made here..
carbon can be sticky *or fluffy*



Here's where the worth of your oil shows up. Stuck rings mean blow-by, loss of power, fuel waste.

When carbon is light enough to blow out the exhaust, better piston seal saves you money on fuel . . .

YOUR RINGS will stay free and active—you will get better piston seal—less "blow-by"—and hence greater fuel economy, if you always use Texaco Lubricants for Diesel engines.

These definite advantages are possible because these oils are made from crudes especially selected for this purpose. They are refined by a process that makes them pure, tough, and able to withstand the grueling punishment met in Diesel cylinders.

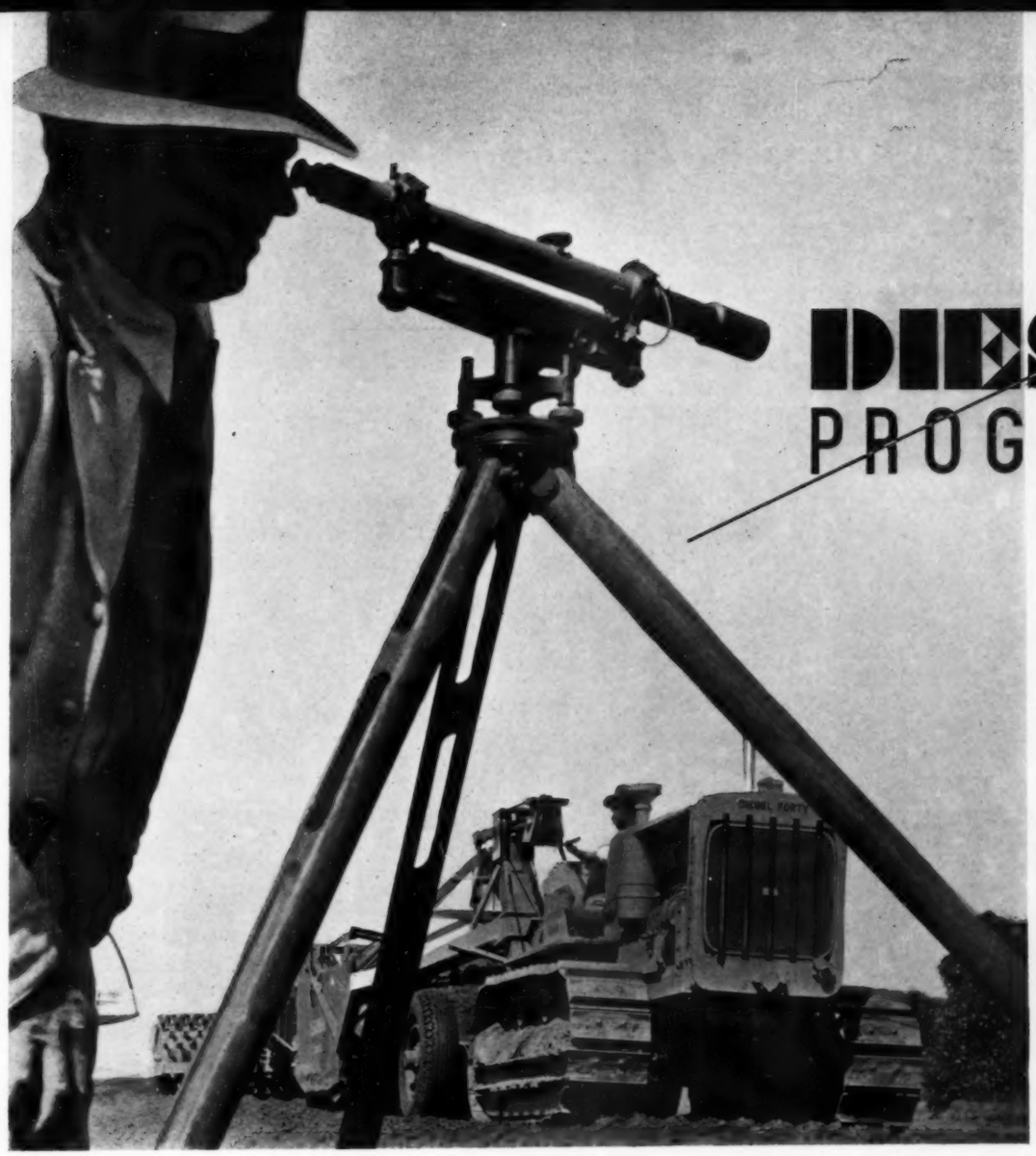
Many oils, not so carefully refined, form gum and carbon which cause piston rings to stick, thereby permitting blow-by, lost compression and wasted fuel.

Because of the outstanding economies enjoyed by many operators, more Diesel engines are lubricated with Texaco Ursa Oils than with any other brand. Order Texaco Ursa Oils for your Diesels.

THE TEXAS COMPANY, 135 East 42nd Street, N. Y. C. • *Nation-wide distribution facilities assure prompt delivery*

TEXACO LUBRICANTS

for Stationary, Marine and Automotive Diesels



DIESEL PROGRESS

CONTENTS FOR APRIL

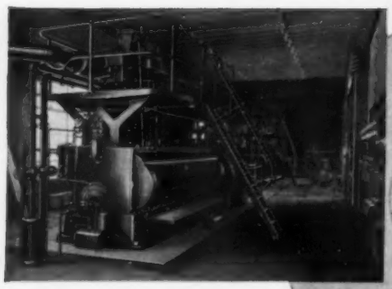
FRONT COVER ILLUSTRATION — A plane's-eye view of a Caterpillar Diesel tractor speeding along the work of plowing by pulling three 5-26-inch disc plows on the Hendrick ranch at Perris, California. Photograph by Orville Logan Snider.

TABLE OF CONTENTS ILLUSTRATION — Caterpillar Diesel Forty pulling new LeTourneau 6-yard scraper, working on an extension of Manchester Avenue between Buena Park and Anaheim, California. Photograph by Orville Logan Snider.

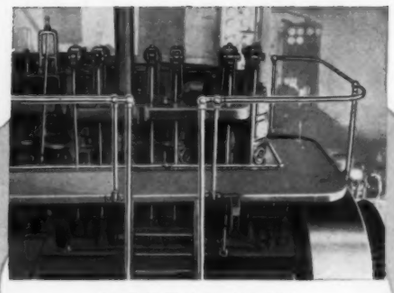
WHAT IS THE USEFUL LIFE OF A DIESEL ENGINE?

Frankly, We don't Know, because—

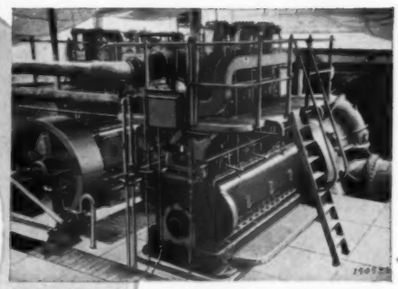
No Ingersoll-Rand Diesel Engine Has Ever Worn Out



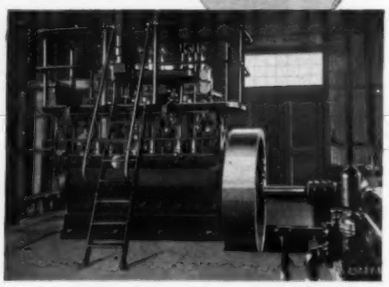
Manufacturing plant installed 1921.



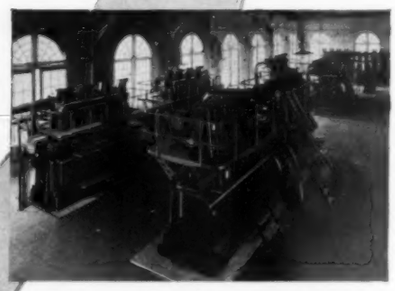
Public Utility installed 1919.



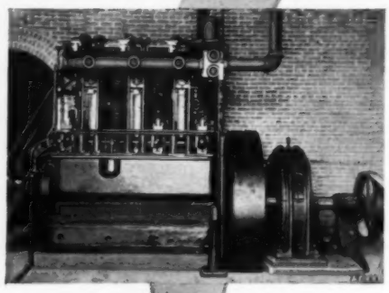
Irrigation service installed 1921.



Oil pipe line pumping installed 1920.



5000 hp. installation in cement plant. First unit installed in 1921.



Municipal power plant installed 1921.

The engines shown are among the first units built by Ingersoll-Rand Company. They can and still do furnish economical power 24 hours per day. These units are installed in widely scattered sections of the U. S. and in one foreign country.

Ingersoll-Rand has built 4-cycle, solid injection engines continuously for 17 years. This type of engine has been brought to a high degree of perfection for marine, stationary and locomotive service in all types of applications.

I-R Diesels are available in sizes from 175 to 1500 hp.
Ask our nearest branch office for further details.

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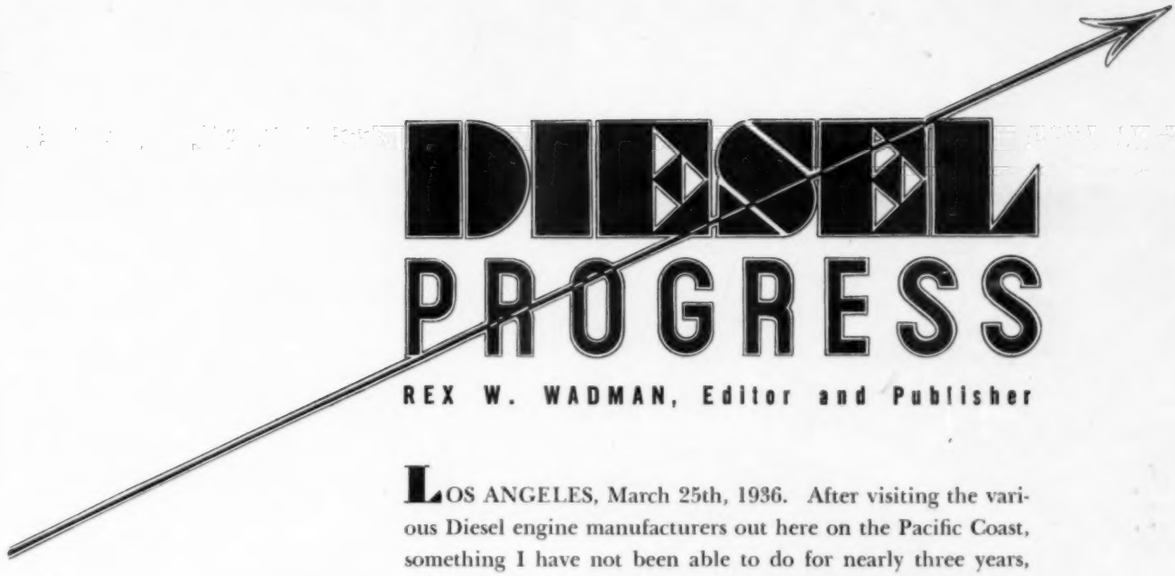


DIESEL PROGRESS

REX W. WADMAN, Editor and Publisher

LOS ANGELES, March 25th, 1936. After visiting the various Diesel engine manufacturers out here on the Pacific Coast, something I have not been able to do for nearly three years, I am struck with two things, one the splendid volume of business going through the shops and the other the improvement in design as compared with engines I saw out here in 1933.

There is a very definite tendency here toward small, compact, fairly high speed units, not necessarily automotive in type, but rather designed for the local market which consists of a substantial marine demand, a huge irrigation market, plus hundreds of different applications of Diesel electric generating sets in small sizes, reasonably priced.

The manufacturers on the Pacific Coast are now enjoying a substantial, profitable business, they are laying plans to enlarge and expand that business. The very nature of their development here makes them potential and powerful contenders for the mid-western and eastern market also, and in the immediate future.

It has also been my pleasure to visit with many Diesel users up and down the Pacific Coast and I am bringing back with me some mighty interesting articles which will appear in later issues. This whole country is a hot-bed of Diesel activity and I have been tremendously impressed with the universal acceptance of the Diesel here, with the broad gauged manner in which users and potential users set out, with an open mind, to apply the principle of Diesel economy, of Diesel dependability, to their own specific power problems. I have found many new uses of the Diesel here and I am going to tell you about these new uses in our May and following issues.

Rex W. Wadman

The exterior of the Freeport Municipal Diesel Plant familiar to thousands who drive along the famous Sunrise Highway. Above — The new 3,000 hp. Busch-Sulzer Diesel recently installed at Freeport, bringing the total number of Diesels to seven and the total horsepower to 11,250.

FREEPORT, LONG ISLAND

By JOHN W. ANDERSON

THE Diesel engine has made spectacular progress in recent years, and the phases which have attracted most attention from the general public have been the automotive, tractor and railway applications, especially the high speed, streamlined articulated trains. The public comes into intimate contact with such services, and its imagination has been fired by these numerous new developments, which have come in such rapid succession.

These applications have been sensational to the engineer also, because he realized what the public could not know, that much technical progress was very necessary before suitable engines could be made available for such work.

Such things have so taken the attention of all that the more prosaic development of the oldest use of the Diesel is apt to be overlooked. It is brought sharply to one's attention at this time, however, by the current installation of the latest unit at Freeport, Long Island, N. Y. This station is characteristic of the problems confronting the owner of a station facing rapid growth. It is interesting to see how they were solved.

Freeport is a growing commuters' town about 25 miles from New York. Its municipally owned power and light plant is located on the west side of the village between the famous Sunrise Highway and the Long Island Railroad tracks. No one riding along the Sunrise Trail can miss the station — a brick building alongside the highway and plainly labeled. In addition, the cooling tower for the engine jacket water in back of the station, is set on stilts and rises to such a height as to be an outstanding landmark in that vicinity.

Mr. John T. Cotter, General Manager of the plant, who has rendered faithful public service to the citizens of Freeport since 1897.

The plant was originally established in 1894 — a steam plant, of course. By 1920 it had grown to an installed capacity of 600 kw. and still more power was required. 'After an investigation by the authorities, it was decided to buy a 250 kw. Diesel unit. This consisted of a Busch-Sulzer four-cylinder four-cycle engine with cylinders 16¼ by 21 inches rated at 365 hp. at 225 rpm., direct connected to a 250 kw. alternator. This was placed in commission in May, 1921.

Freeport was sharing the rapid growth of suburban New York, and the village of 7,000 was beginning to grow rapidly. This meant an increase in load, and it was soon found that the Diesel was running all the time. Thus there was no reserve generating capacity available. In the meantime the economies of the Diesel were proving themselves to the village authorities, so that when it became necessary to add more power, it was natural to add another Diesel.

The second unit was placed in operation in January, 1923. It was a four-cylinder two-cycle engine with cylinders 17 by 27 inches, rated at 750 hp. at 180 rpm., and direct connected to a 500 kw. alternator. The third unit was a duplicate of the second. Thus the transition from steam to Diesel was undertaken as the load increased, and as the Diesels gave further proof of their reliability and economy. The accompanying plot shows the steady and rapid growth in station capacity to meet the load requirements.

The engines for units 4 and 5 are similar to engines 2 and 3 except that they have six cylinders. Number 6 has eight cylinders. Of course, many minor improvements in design were made in the successive engines, but in general the design of units 2 to 6 is the same.

The engines for units 7 and 8 are, however, of an advanced type.

While the village has a population today of about 20,000, a large portion of the increase in load can be traced directly to the increased use of electrical household appliances.

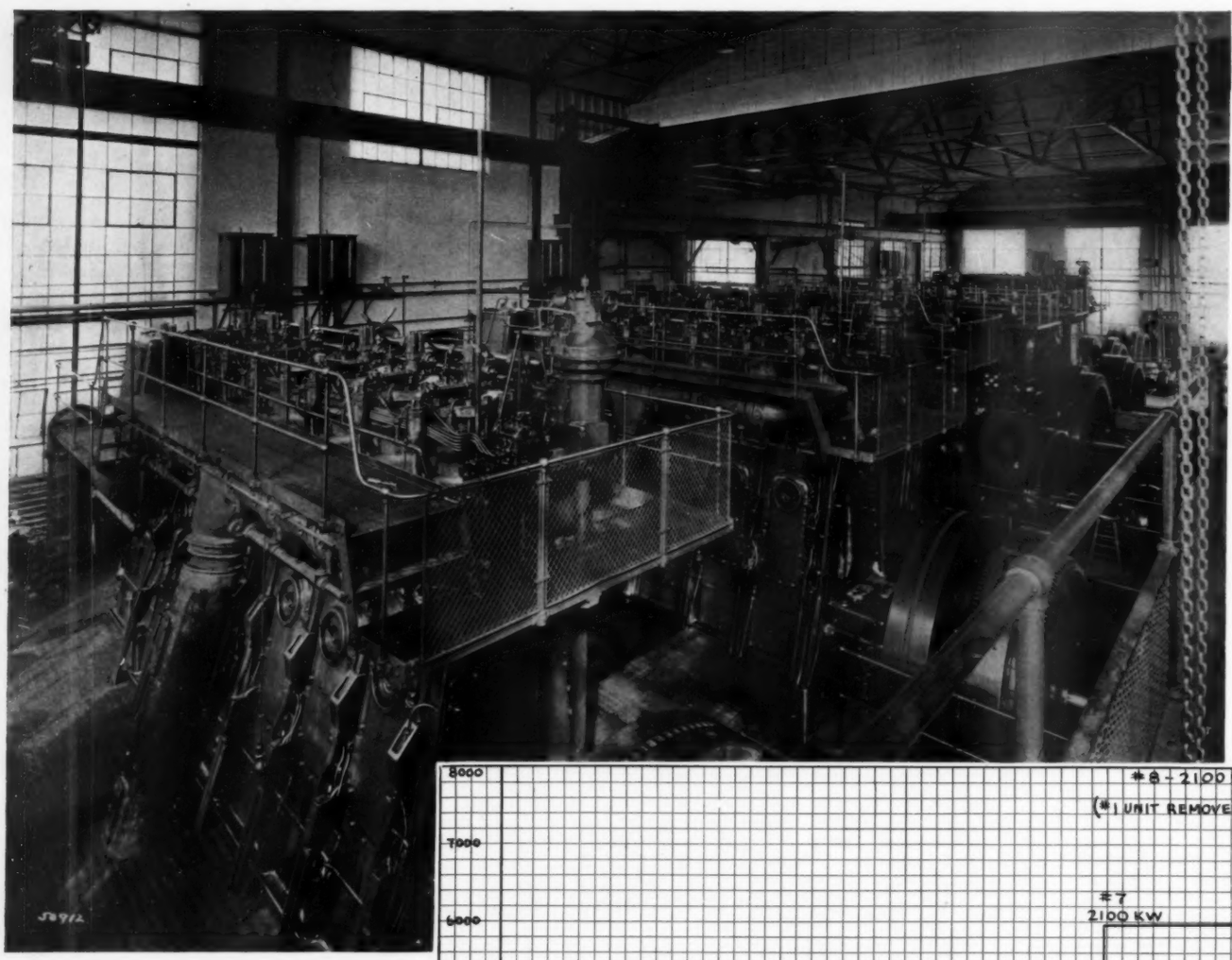
This increase in load is interesting enough in itself, but there is another phase frequently

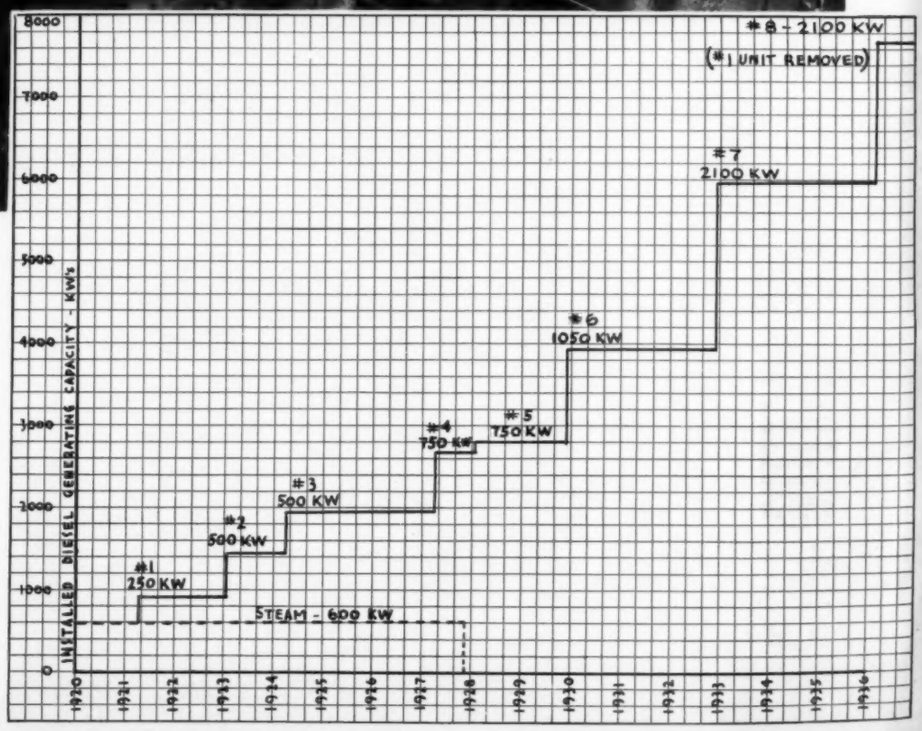
overlooked. How did Freeport succeed in meeting this problem of such extensive additions without major changes in station design? It was because of important developments in engine construction. In other words, the stationary Diesel, the original service application of the Diesel, has yielded to improvements which have brought marked reductions in the weight and space required for a given power.

The original unit in this station was installed alongside the steam engines, but as the other Diesels were added it became necessary to look forward to a permanent arrangement to accommodate the future units. The usual parallel arrangement of units was adopted. Units 2 and 3 were installed on the east side of the original engine. When number 4 was added, a new building addition to the west was built with space available for additional units between it and number 1.

When the latest unit, number 8, became necessary, the original unit was removed to make room for it. The width of all the units is so nearly the same that this was entirely feasible. This places the latest and largest engines in the middle of the station.

The crane which serves all the Diesels, except 4 and 5, has a span of 45 feet 3 inches. The crane which serves 4 and 5 has a greater span than the other, but as far as the actual engine





A Diesel panorama at Freeport, one of the few plants in the United States which can boast such a concentration of Diesel horsepower.

layout is concerned, the original crane could serve by proper extension of the crane tracks.

This gives a generous amount of length for the 500 kw. units, and a comfortable amount for the 750 kw. units. In the case of the 1,050 kw. unit, number 6, the compressor extends into the building extension on the north of the engine room, and is served by a special I-beam trolley and hoist, because the generator end is set back to provide additional space in front of the switchboard. The latest 2100s go in because of a more compact design.

The Vortex silencer and spark arrester being installed for the new 3,000 hp. unit.

All of the earlier engines were of the air injection type, and all (except number 1) have attached piston type scavenging air pumps. These items require extra length on the end of the engine beyond the working cylinders. The 2100s are solid injection, and the scavenging air is supplied by 250 hp. motor driven centrifugal blowers, located in the station basement in the north building extension. These engines have ten cylinders 19½ by 27 inches and are rated at 3,000 hp. at 240 rpm. Due to the number of cylinders and the high speed of rotation, it is possible to use a flywheel type generator and save the length usually required for the separate flywheel such as used on all of the other engines. Thus the overall unit length becomes about 41 feet, or well within the existing crane span.

Due to the use of the trunk piston, a saving of overall height has also been effected. The earlier engines, except number 1, are of the cross head type and require 17 feet 3 inches from the floor level to lift the pistons clear and get them out of the engine. The latest engines require a height of 19 feet 8 inches to do this. Thus the original crane height of 21 feet has been ample for all requirements.

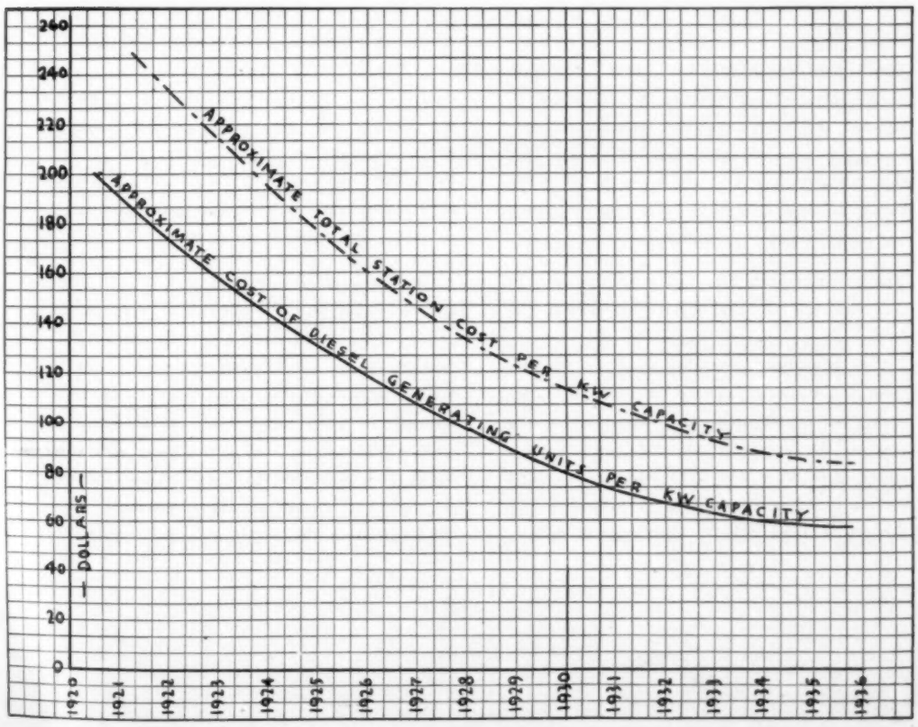
It should be noted that unit number 1 was removed not because it was worn out or had become too obsolete to be of service, but rather because it was too small in size to serve usefully in carrying any of the station load.

Another interesting phase of the development is the plot showing the costs per kw. of the engines such as installed in this installation. The lower curve represents the cost of the engine and generator unit delivered and installed, while the upper curve includes the building, engine foundation, piping, water cooling system and other items to make the complete station installation. The drop in cost is noteworthy, and it is just as important to note why. There are several reasons. First is the increase in the size of the individual unit. Second, there is the factor of reduced manufacturing costs. Improved shop practices have cut the cost of building an engine. Third, there has been a reduction due to the advance in design. Units 7 and 8 develop nearly 65 per cent more power per cylinder than the earlier engines, and one-half of this gain comes from an increase in piston and rotative speeds. The trunk piston and other mechanical design detail also contribute their share. All of the improvements in design have tended to lower the cost of construction, and they have been possible because of modern development trends. The result is a lowered overall installation cost per kw. installed, and thus a lowered overhead or fixed cost charge against the power generated.

These latest engines offer many distinctive features which invite attention. There is no valve gear on the top of the engine. The control is entirely from the floor, and the fuel injection pumps, governor, starting timing valves are all grouped at the generator end on one side of the engine at a convenient height from the floor level. The operator need never go up on the engine except to inspect the cylinder heads or the parts and piping adjacent to them.

The pistons have oil cooled forged steel heads with the tops shaped to form the lower boundary of the combustion chamber. The wrist

. . . . *And now please turn to page 43*

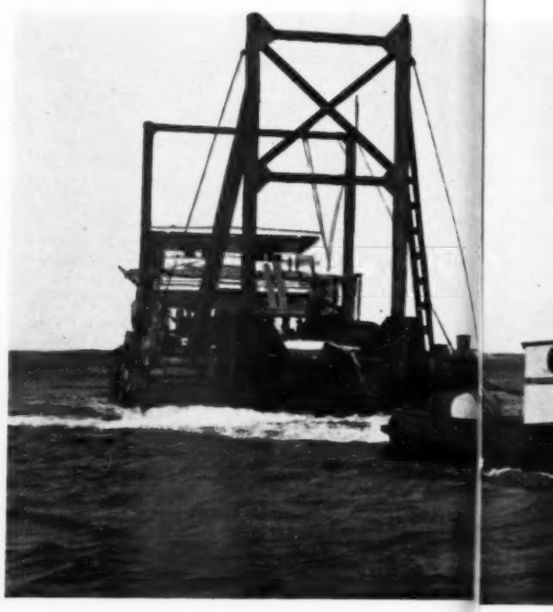


The plot at the left shows the rapid growth in plant capacity — how from a modest beginning the station has become of substantial size. Note the combined operation of steam and Diesel engines, and the complete change-over to Diesel operation only after the capacity of the plant had been built up to the point where the Diesels could carry the entire load.

The reduction in cost of generating units such as installed in this station is interesting (see graph). Three influences acted in a common direction — the increase in the individual size of the unit, the reduction in manufacturing costs during that period of time and the improvements in design. All these combined to lower the costs of the individual units as measured in dollars per installed kw. capacity.

The 41-foot towboat "Fannie D" equipped with a 6-cylinder Caterpillar Diesel.

THE "FANNIE D" GOES DIESEL



FOR many years, the trim towboat *Fannie D* has been a familiar sight along the waterfront at Houston and Galveston, Texas, as she plied the waters of the Houston Ship Canal bringing freighters back and forth to the gulf and towing barges and dredges through the canal. But trim and capable as she was, the *Fannie D* was just another tug until she came from the ways recently after a complete overhauling. Now the eyes of skippers and marine engineers are focused on her, not because of her gleaming new paint, but on account of the interesting Diesel engine installation made in her staunch hull while she was in dry dock.

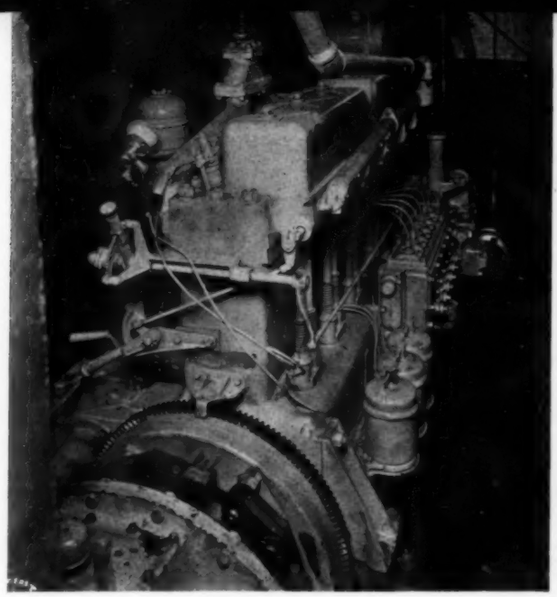
Diesel driven tugs are no novelty, but this marine engine is different. It is known throughout the world as a dependable, economical source of power for tractors and other dry land machinery, but it is a comparative newcomer in the marine field. Nevertheless, it was selected for its job by an owner with a wealth of Diesel experience. Skipper Ernest Eggers has served three of the oldest Diesel manufacturers in Germany and America as test engineer. More recently he has been in charge of the Diesel tractor fleet and the Diesel-electric dredge *Duplex*, owned and operated by the Sternberg Dredging Company. He knows Diesels from both the manufacturing and operating standpoints.

The engine he purchased to drive the 41-foot *Fannie D* was a 6-cylinder Caterpillar rated at 125 maximum brake horsepower at governed speed of 900 rpm. It drives a three-blade, 44-inch propellor with 28-inch pitch at a maximum speed of 450 rpm. The load was calculated at 100 hp., well within the power rating of the engine and to obtain this propellor speed in both forward and reverse as well as lower intermediate speeds, a Twin Disc reverse and 2 to 1 reduction gear assembly was installed between the engine and the propellor shaft. The reduction unit is built into the reverse gear and reverse speeds are equal to forward speeds. Both the reverse gear and the engine have three-point mounting and the drive from the engine to the reverse gear is through the standard Caterpillar flexible coupling, thus eliminating any strain on these units even if misalignment should occur along the engine bed.

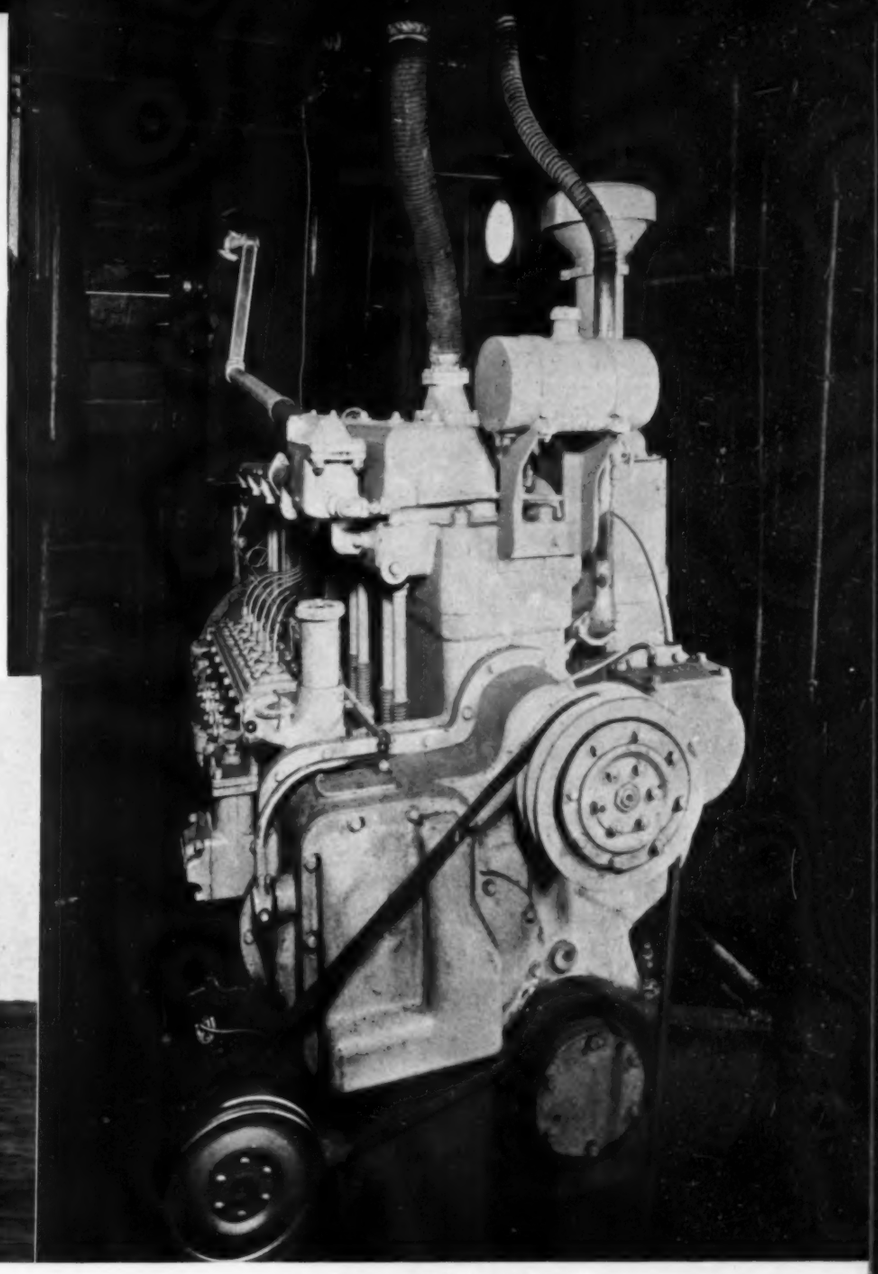
Two sets of bronze and steel clutches, hydraulically operated and running in oil, control all forward and reverse speeds. Instant response and great ease of operation are claimed for this installation. A single lever in the pilot house can be operated with one finger to secure any forward or reverse speed.

The cooling system has been modified to meet the demands of the service in which the *Fannie D* is engaged. Since she will operate largely in shallow or muddy water, an internal fresh water cooling system was installed, consisting of an 80-gallon tank mounted in the rear of the engine room and fitted with a gauge glass, filter and vent connection. The standard engine thermostats are retained and the outlet from the front thermostat is connected to the top of the fresh water tank. From the bottom of the tank a line runs to a Simms heat exchanger installed in the port wing. From the heat exchanger, another line leads to the standard water pump, which circulates the water through the entire system.

At the front of the engine, replacing the usual fan, a V-belt sheave operates at 1.43 times crankshaft speed driving a 12-volt automotive type generator, which charges storage batteries for the lighting system, and a 2-in. Goulds centrifugal salt water pump. This pump is fitted with a strainer on the suction line and two inlets, each equipped with gate valves, are installed in the bottom and side of the hull. The discharge from this pump first passes through



The Caterpillar installation in the "Fannie D".



View of Caterpillar Diesel installation taken from the pilothouse looking aft.

"Fannie D" towing a heavy dredge and a quarter boat from Harrisburg to Galveston against wind and tide.

the small heat exchanger which cools the lubricating oil from the reverse gear and then circulates through the larger Simms heat exchanger on the cooling system, before it is discharged overboard.

The reverse gear is of exceptionally sturdy construction with all shafts carried on antifriction bearings. It is equipped with a gear type lubricating pump delivering oil at 130 lbs. pressure to all the bearings and the control cylinder. The gear case acts as a sump and lubricating oil is circulated through the cooler each time it is pumped through the line.

The standard governor is used and has been found entirely satisfactory, since load characteristics are very similar in marine and tractor service. The standard Caterpillar starting system is employed, consisting of a 2-cylinder, 4-cycle spark ignition engine mounted on the left side of the cylinder block. All operating controls are grouped in the pilot house including the helm, speed change lever, oil and fuel pressure gauges and fuel tank gauge.

How well the installation had been worked out by owner Eggers and sales engineer C. F. Reynolds of the Gulf Tractor and Equipment Co. of Houston, was amply proved as soon as the *Fannie D* slid down the ways. For the first fifteen hours, she was operated on light loads near Houston. Then she was given her first real test — towing a heavy dredge and a quarter boat from Harrisburg to Galveston against wind and tide. The trip required sixteen hours of full load operation, but at the end of the run no lubricating oil could be added to the sump and the exhaust was free from smoke throughout the entire test.

The return trip was made light against the tide, and the running time was six hours. At the end of her maiden voyage, the *Fannie D* had fully justified the advance predictions of her owner. She had greater power and lugging ability than ever before and, best of all, she had a new operating economy that promised to repay the owner for the cost of reconditioning the craft in a comparatively few months.

DIESELS ON FLOOD CONTROL

By F. HAL HIGGINS

The ideas expressed herewith by F. Hal Higgins are not necessarily those of the Editor

To followers of the world-wide movement now sweeping across man's activities to equip him with cheaper and more efficient power as found in the Diesel and oil engines compared to gasoline, steam and other forms of power, the Los Angeles Flood Control District is at the present time something to see and talk about. It's a big step forward and an example to both contractors and other governmental agencies, especially to most of the New Deal alphabetical set-ups that have been trying to get heavy construction work done with relief labor.

On the other hand, it seems to the writer, it's a great lesson to Diesel engine builders of what they missed. The fish that wasn't caught was bigger than the ones brought home on the string. Briefly, the great engineering organization that built the Panama Canal, handled the Mississippi levee work the past ten years and made the War Department's reputation for efficient handling of dirt moving something high and lofty in engineering annals wanted to "go all-Diesel" as nearly as possible. The U.S.E.D.—United States Engineering Department—is sold on Diesels from experience on the Mississippi levees during the past few years. Also, with thousands of relief workers to handle and most of the $14,000,000 job here in close proximity to a large population and heavy traffic of nomadic workers and tourists, "leakage" of governmental gas is an important item. Burning Diesel fuel in power equipment means saving fuel two ways: cutting fuel costs burned and completely stopping leakage to cars owned by workers and passersby.

So, the engineering staff went as far as it could in the purchase of equipment that it felt was ready to perform in the hands of green operators and that was being produced by reliable concerns that could supply the equipment in volumes needed. After buying Diesel and oil engine tractors, shovels and draglines, the question of trucks came up. They would like to have started with a fleet of 50 Diesel trucks. If they proved okay from the outset, the full initial order of 102 motor trucks might conceivably have been Diesel. But there was enough of a question among these sound engineers to cause them to stick to gas trucks, and so International Harvester took a little order for 104 of that kind. The Internationals are doing a great work, too. The operators and engineers all like them. Through rains and mud, they are delivering rock from the canyon quarries, much of it over 30-mile hauls.

Yet, the writer is sure that any Diesel manufacturer who has been selling his engines for truck use the past two to four years will insist his engine could have done the job. The writer has seen plenty of them on the Coast doing tougher jobs with more backing, stopping and turning than involved here. It strikes him that the Diesel engine builders weren't ready to sell a market that was ready to buy. A closer hook-up of engine and truck builders, plus a sales story in moving and still pictures of what Diesel trucks are already doing, might have swung the War Department to Diesel trucks on this job, then on all jobs, and finally Dieselized the Army where the transport of fuel in war time is so important that it will win battles and wars.

Starting with Captain Claterbos and Captain George K. Withers, Chief and Assistant Chief, respectively, of the Operations Division of the Los Angeles Engineer District, the writer and cameraman were given every opportunity to

see the equipment and work of the U. E. Engineering Department on the Flood Control work in Los Angeles County. For a week, with a guide from the Mechanical Section, we followed rivers, creeks, canyons, washes, quarries and other activities through rain and sunshine. In spite of having to contend with close to 10,000 relief workers, the work is going ahead and shaping up into a much-needed job of city's suburban populations in recent years with the clearing away and burning off of mountain grass and shrubbery that formerly checked the run-off of heavy rains at certain seasons.

We saw some fifty pieces of Diesel-powered equipment. As mentioned, all tractors, draglines and shovels are either powered with Diesels or oil engines. Pavers and concrete mixers are other items not Dieselized that Diesel manufacturers went to sleep over, it seems. There are none on the Coast yet, though one or two on the New York area front, we understand. Here again engine builders might have gotten closer to paver and mixer manufacturers with the government wanting that combination.

But here's about the way the Diesel show

Top illustration — Buda Diesel engine powers this Osgood shovel at Eaton Canyon, Wash. Middle — A fleet of five of these Hercules Diesel powered Cletrac 80s has made tractor history from the start of the U.S.E.D. Left — Three of these Cummins Diesel powered Osgood draglines, swinging clamshell buckets went on the job and immediately demonstrated their place in dredging sandy creek bottoms for the U.S.E.D. job.

looked as we hunted it down from four area depots out to river, creek, wash, quarry and outlet jobs:

Tractors: 5 Cletrac 80s with Hercules Diesel engines
3 Allis-Chalmers with that make of oil engine developed from Waukesha-Hesselman rights
12 Caterpillar Diesels

Draglines: 4 P & H with Fairbanks, Morse Diesel engines
3 Limas with Waukesha-Hesselman engines
4 P & H with Caterpillar Diesels
7 Osgoods with Hercules Diesel engines
4 Bucyrus-Erie loadmasters
3 Osgoods with Cummins Diesel engines

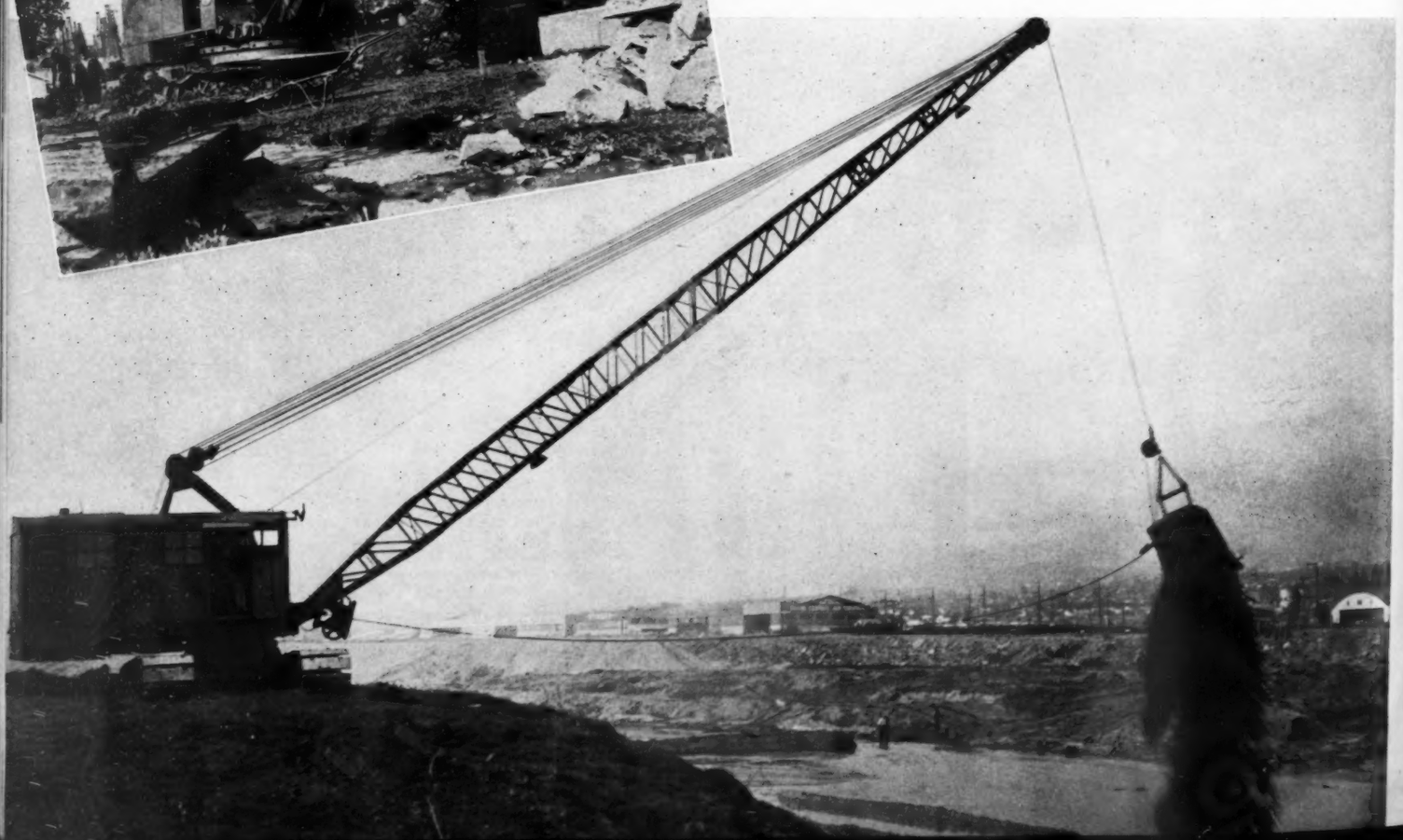
Shovels: 1 Bay City with Cummins Diesel engine
4 Bay City with Hercules Diesel engines
4 American Gophers with Waukesha-Hesselman engines
2 Osgoods with Buda Diesel engines

The $14,000,000 appropriation made for this work is to be used only for active construction work, the district being required to furnish rights of way and other items to total of about $3,000,000 more. Excavation operations precede concrete work on the channels, draglines being used for most of this excavation. Form construction and concreting follow the draglines. Debris basins are constructed to catch the heavy material carried down from steep slopes in the territory north of Glendale.

Work is divided roughly into three general classes: 1. Channels for flood control and drainage; 2. rip-rap levee work, and 3. debris basins. Of the four field areas, three have much the same work, the fourth being devoted more to harbor work at Long Beach, San Diego and Newport Bay.

Work is to be completed early in November. Be sure to see this job if you are on the Coast this year. It's a big Diesel step forward, but the biggest one got away.

P & H shovel powered by a Waukesha-Hesselman engine is building a sump for the U.S.E.D., and below, a P & H dragline powered by Fairbanks, Morse Diesel tearing off a corner of the Los Angeles River Bank and tossing it back for a temporary dam to divert the water while U. S. Engineers shape up the river for flood control.



EDITOR'S NOTE

As this article goes to press head lines flash news of flood disaster in New England, Pennsylvania, West Virginia and Ohio.

Quite obviously Los Angeles has no corner on the flood control problem and serious stops must be taken along these lines in the East as well. Diesels should play a major role in this work and do their bit to reduce the cost of such preventative measures which will be as expensive as they are necessary. The adaptability of the light-weight, high-speed Diesel to shovels, draglines and tractors is being hailed with enthusiasm wherever contractors have tested it. Diesels and flood control quite properly go hand in hand.

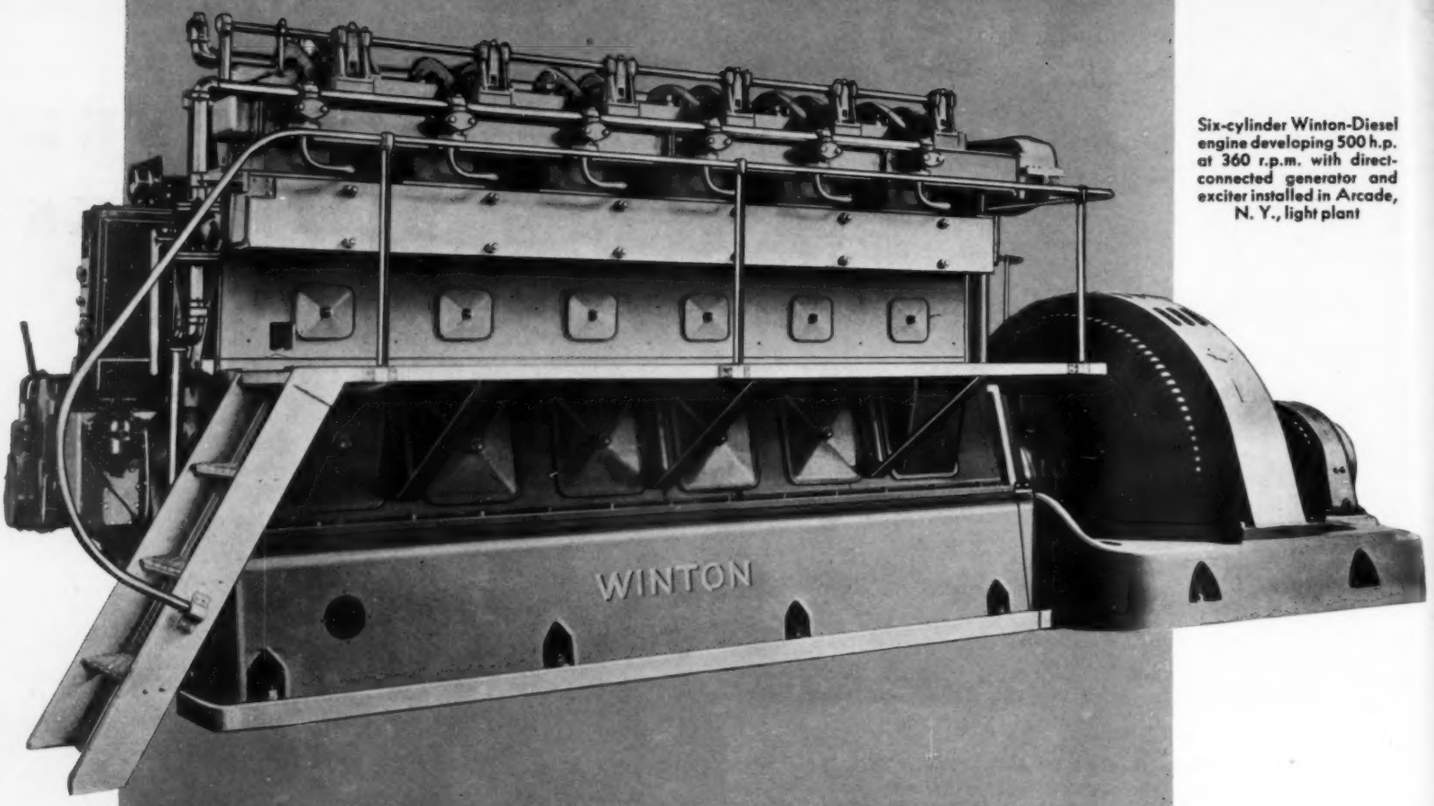
DIESEL TRUCKS IN THE EAST

Above — Waukesha powered Diesel Autocar owned and operated by The Davidson Transfer & Storage Company, Baltimore, Maryland. One more of the many Diesel trucks now giving dependable and economical service over eastern seaboard highways.

Top, Right — The new Sterling truck recently supplied to Needham's Motor Service, Inc., Philadelphia, powered by a 125 hp. Cummins Diesel. This truck is hauling a maximum gross train weight of 50,000 lbs. over all types of road conditions at a fuel cost of less than 1 cent a mile, and 25 per cent time reduction in operating schedules.

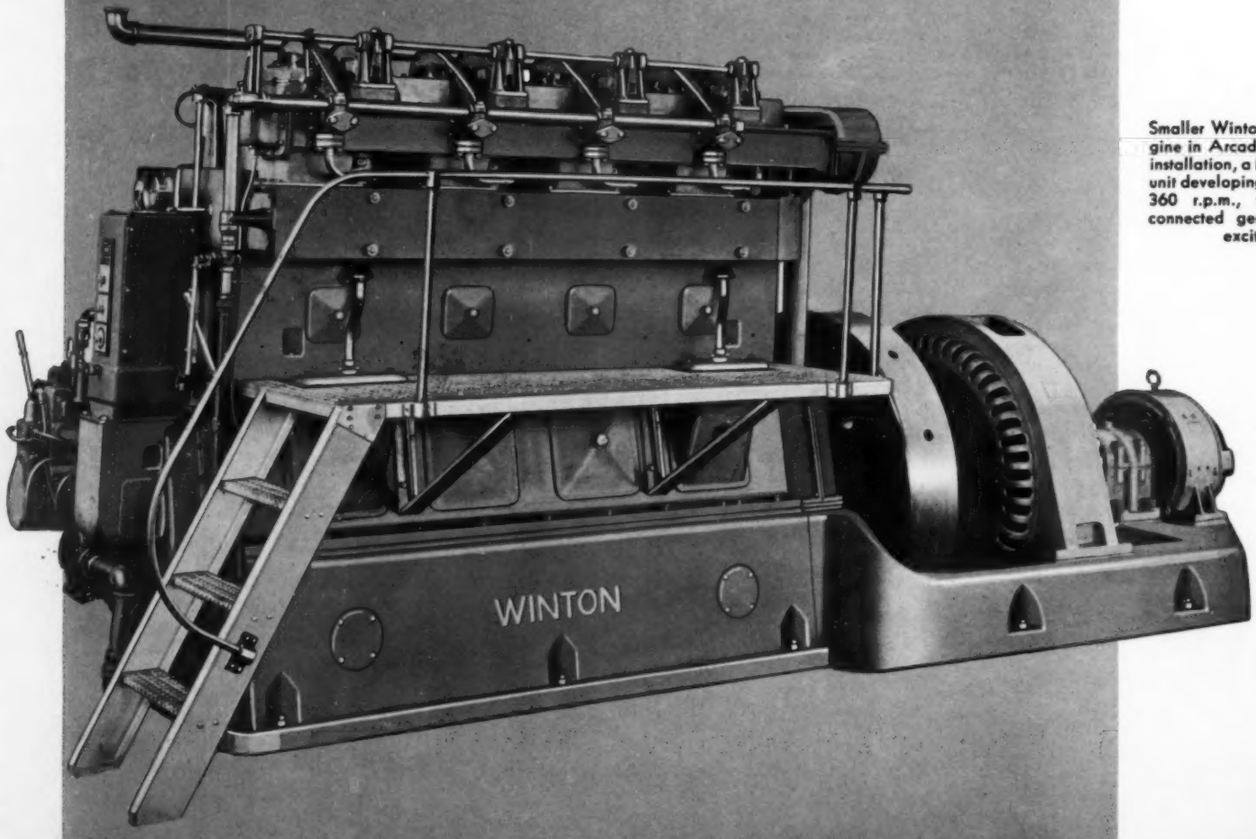
Below — Another Waukesha Diesel enters freight highway service. This 151-in. wheelbase Autocar de luxe cab truck has been in the service of the Horton Motor Lines, Inc., Charlotte, since the Spring of 1935.

Above — Shell Eastern Petroleum Products, Inc., Diesel tank truck. The unit is an Autocar de luxe cab type containing a Waukesha Comet Diesel engine. The capacity of the high tensile steel tank is 3,200 gallons.



Six-cylinder Winton-Diesel engine developing 500 h.p. at 360 r.p.m. with direct-connected generator and exciter installed in Arcade, N. Y., light plant

Symbol of Economy and Dependability



Smaller Winton-Diesel engine in Arcade light plant installation, a four-cylinder unit developing 325 h.p. at 360 r.p.m., with direct-connected generator and exciter

WHERE *Economy* IS THE WATCHWORD

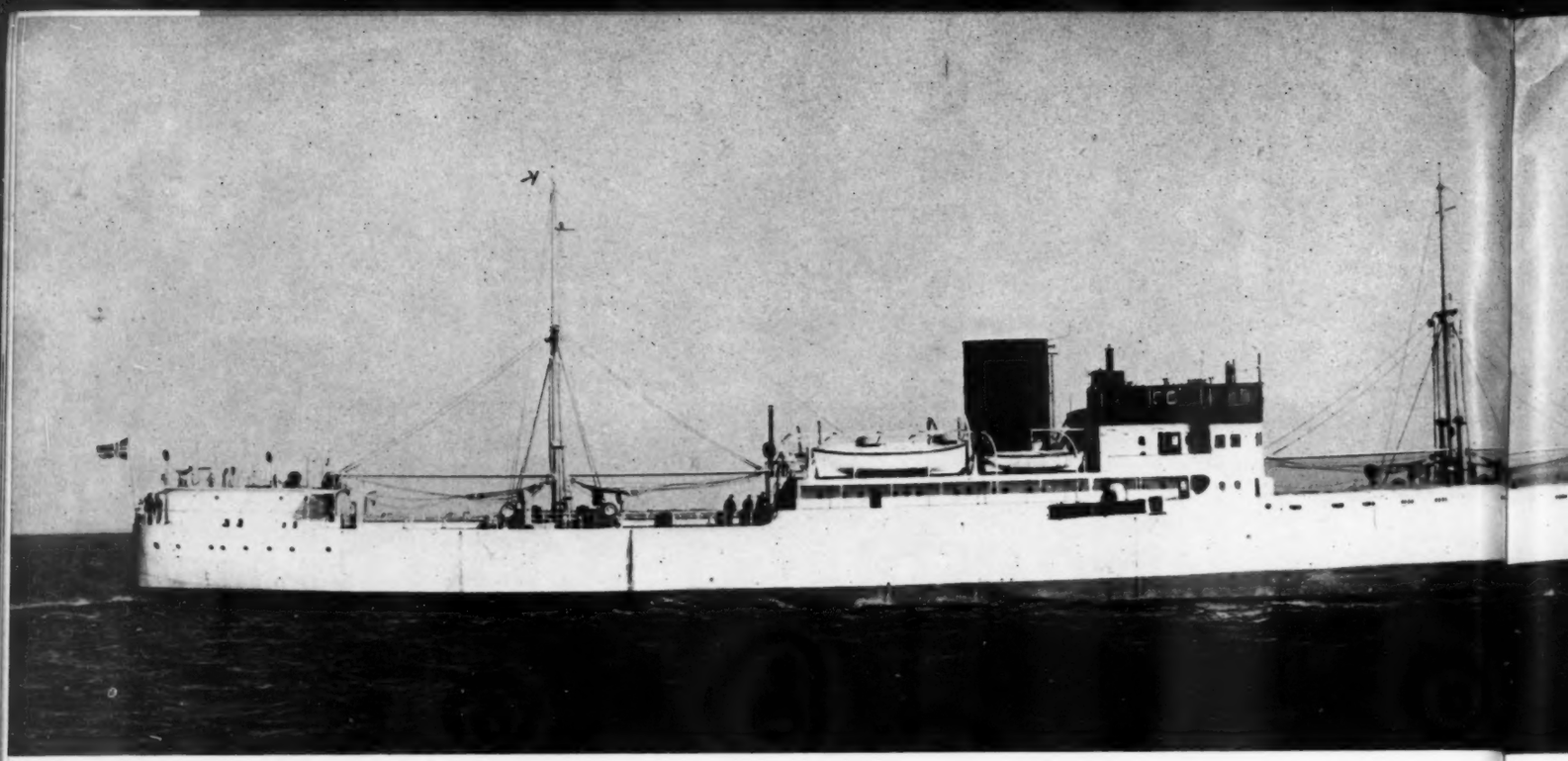
..WINTON-DIESEL POWER

IS THE "*Buy*" WORD

FURTHER proof of this interesting fact is in evidence at the municipal light plant at Arcade, New York, where two Winton-Diesel engines have been installed to furnish power formerly supplied by an outside source. One 500 h.p. six-cylinder Winton-Diesel and one 325 h.p. four-cylinder Winton-Diesel now operate with uniflow steam engines which run during winter months to supply exhaust steam for the heating of school buildings and for commercial heating of the city. During the non-heating period, the Winton engines will carry the entire load. This combination of Diesel and steam power provides the utmost in economy and points the way to a very worthwhile saving in the operating budget of Arcade . . . one more example of the manner in which advanced-type Winton-Diesels meet the demand for dependable, efficient power at the lowest possible cost.

WINTON ENGINE CORPORATION

CLEVELAND, OHIO, U. S. A.



LONDON LETTER NO. 5

By GEORGE LIND

IN 1935 the world output of marine Diesel engines exceeded that of 1934 by some 30 per cent, and was approximately double the 1933 figure. The revival of the European shipping industry was mainly responsible for this amazing increase – an increase, incidentally, that has been steadily maintained during the first three months of 1936.

As in the past, Great Britain has easily held her leadership as premier motor-shipbuilding country of the world, her total of 40 motor vessels completed during 1935 being exactly double that of the runner-up, Germany. The total world production of marine horsepower for 1935, excluding ships of less than 1,000 tons, was just under three quarters of a million, Great Britain and Germany accounting for 300,000 ihp. between them. Next in order came Japan with 78,000 ihp., Sweden with 76,400 ihp. and Denmark with 73,500 ihp.

As far as the type of machinery is concerned, the two-stroke engine is still the most popular, the proportion of single and double acting units remaining about the same. Here are some figures showing how the totals for 1934 and 1935 were made up:

	1934	1935
Four stroke single acting	27	49
Four stroke double acting	..	..
Two stroke single acting	36	47
Two stroke double acting	22	33
	85	129

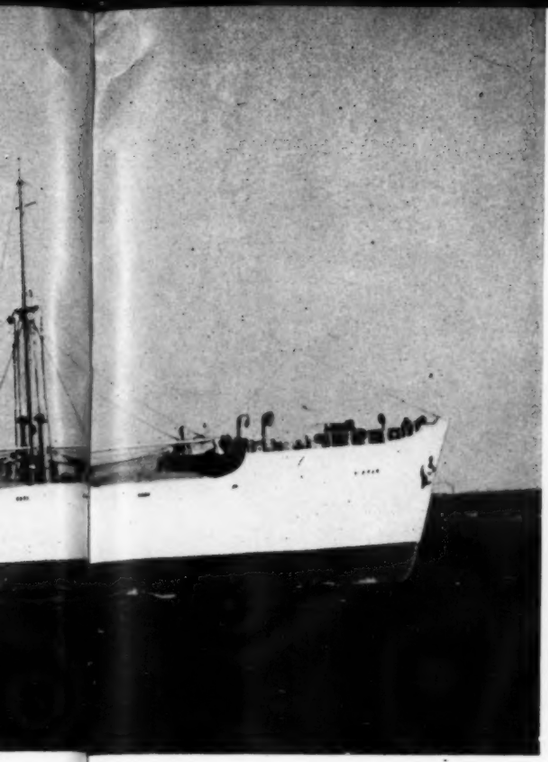
Technically, the most interesting development has been the successful utilization of really large marine Diesels. Previously, the size and speed of a motor ship was largely governed by engine power, the biggest vessels normally being of about 20,000 tons, with speeds of around 18 knots. With the perfection of power units of 12,000 and 14,000 bhp., however, the way has been opened to an entirely different class of ship, namely, the 25-knot 26,000 tonner.

So much for generalizations. Now for a short survey of the year's outstanding launches. First and foremost comes that magnificent new ocean greyhound, the R.M.M.V. *Stirling Castle*, pride of the famous Union Castle Line.

Built at Messrs. Harland and Wolff's yards at Belfast, and despatched on her maiden voyage on the 7th of February of this year, the *Stirling Castle* represents the last word in motor ship design and comfort. She is 725 ft. in length, has a molded width of 82 ft., a gross register of 25,550 tons and provides accommodation for 789 passengers. As will be seen from the accompanying photograph, her proportions are well nigh perfect, the graceful bows, semi-streamlined superstructure and sleek, solitary funnel giving a wonderful impression of neatness and speed.

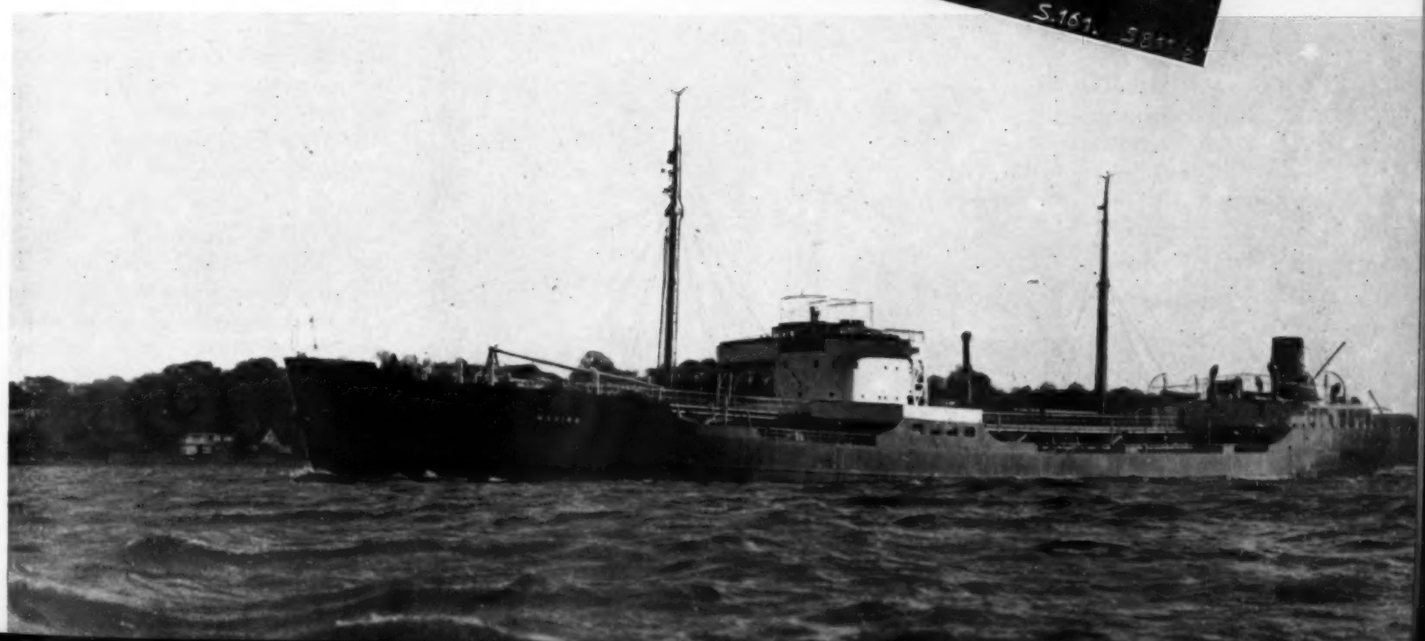
The propulsion machinery is the most powerful ever constructed in the British Isles, and consists of two 10-cylindered Harland-Burmeister and Wain two-stroke, double-acting, airless injection engines of 12,000 bhp. each. The cylinders have a diameter of 25.9 ins. and a stroke of 59 ins., the normal speed being 102 rpm. So far, no trial data are available, but this figure should be equivalent to about 22 knots at sea.

Constructionally, these engines differ considerably from other two-stroke, double-acting units,



The fruit carrier "Vibvan" equipped with a B&W Diesel, developing 4,500 ihp. at 160 rpm.

Control station of the 4,100 hp. double-acting two-stroke A.E.G.-Hesselman engine used on the motor tanker "Marina" and below is the "Marina" under way on one of her early voyages which proved so highly successful.



the emptying of the cylinders being obtained by what is termed "uniflow scavenge." In this system, air enters through ports in the center of the bores, and the exhaust gasses are discharged through piston-type valves in the top and bottom of the cylinders, respectively. The piston valves are oil-cooled and are driven by means of rods from a layshaft in the crank case. The lower of the valves is bored in order to allow the main piston rod to pass through it, and piston rings are fitted inside and outside.

Apart from the *Stirling Castle*, a number of very striking smaller motor ships have been launched during 1935, the so-called "economy ship," *Sutherland*, being an interesting example. She is a cargo tramp with a gross register of 4,956 tons, and was built at the Sunderland yards of William Doxford & Sons, Ltd. Her dimensions are.

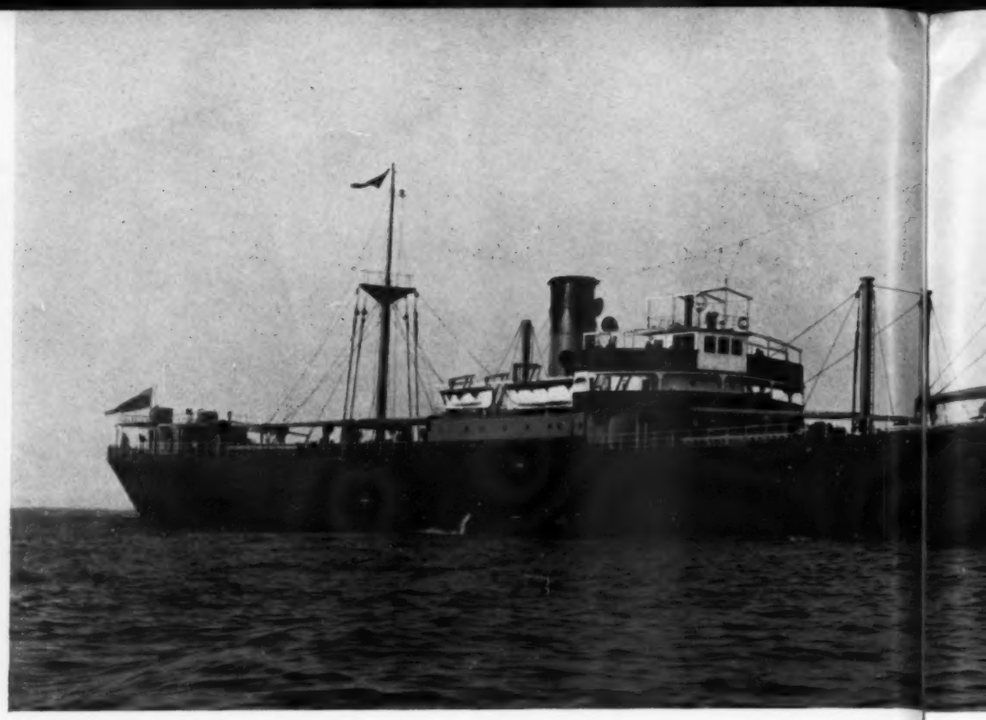
Length on the waterline	422 ft. 9 ins.
Molded beam	54 ft. 3 ins.
Molded depth	28 ft. 8 ins.
Engine power	1,800 bhp. at 115 rpm.
Speed	11 knots

The engine is a three-cylinder, airless-injection unit of the opposed piston type. It is of special Doxford design and has proved remarkably economical in service. To illustrate this point it may be mentioned that on one of the *Sutherland's* recent 2,000-mile voyages, with the ship fully laden and the engine developing its maximum rated horsepower, the fuel consumption was only 6.19 tons per day—half a ton less than the average for this class of vessel, and about two tons less than that required for a steamer of the same size and speed.

Another type of ship that is relying more and more upon marine Diesels for its motive power is the tanker. Of recent years the number of these vessels has increased by leaps and bounds, and this report would certainly not be complete without a description of, at least, one modern motor tanker.

The particular ship to be dealt with here is the German-built *Marina*, owned by the A/S Tanktransport (Thomvald Berg), of Tonsberg, Denmark. She is typical of the 15-odd motor tankers on order at various European shipyards and has a gross register of 9,897 tons. As regards general design, the principal features are the use of a special hull form, known as the Deutsche Werft-Speedy Lines, and the careful streamlining of all deck erections, according to the plans of Mr. Paul Kavli, under whose supervision the ship was built.

The *Marina* has a length between perpendiculars of 483 ft. 5 11/16 ins., a molded beam of 65 ft. 9 ins., a depth of 35 ft. 11 ins. and a dead-weight capacity of 14,823 tons. The main engine is a 6-cylinder A.E.G. Hesselman double-acting, airless-injection, two-stroke unit of 23.6 ins. bore and 43.3 ins. stroke, its designed output being 4,100 rhp. at 118 rpm. All the necessary auxiliaries, such as cooling water and bilge pumps, are chain driven direct from the mainshaft, and apart from a dynamo for generating current for the electric steering gear, no independent auxiliary engines are running at sea.



The first trip made by the *Marina* was from Hamburg to the Black Sea and back, and so satisfactory were the results that after only a day's stay at Hamburg she left again on her second voyage. On the round trip, the performance data showed that the engine developed 4,270 bhp. at 120 rpm. fully loaded, the speed through the water being 13 knots, and the mean indicated pressure in the cylinder 77 lbs. per square inch.

The fourth, and last, ship to be described is the M.S. *Vibran*, representative of yet another class of vessel for which Diesel power is eminently suitable. She was built by the Elsinore Shipbuilding and Engineering Co., Ltd., of Elsinore, Denmark, for the account of Mr. Ole Andreas Knutsen, of Haugesund, and is a refrigerated fruit-carrying ship of the very latest type. Her principal dimensions are:

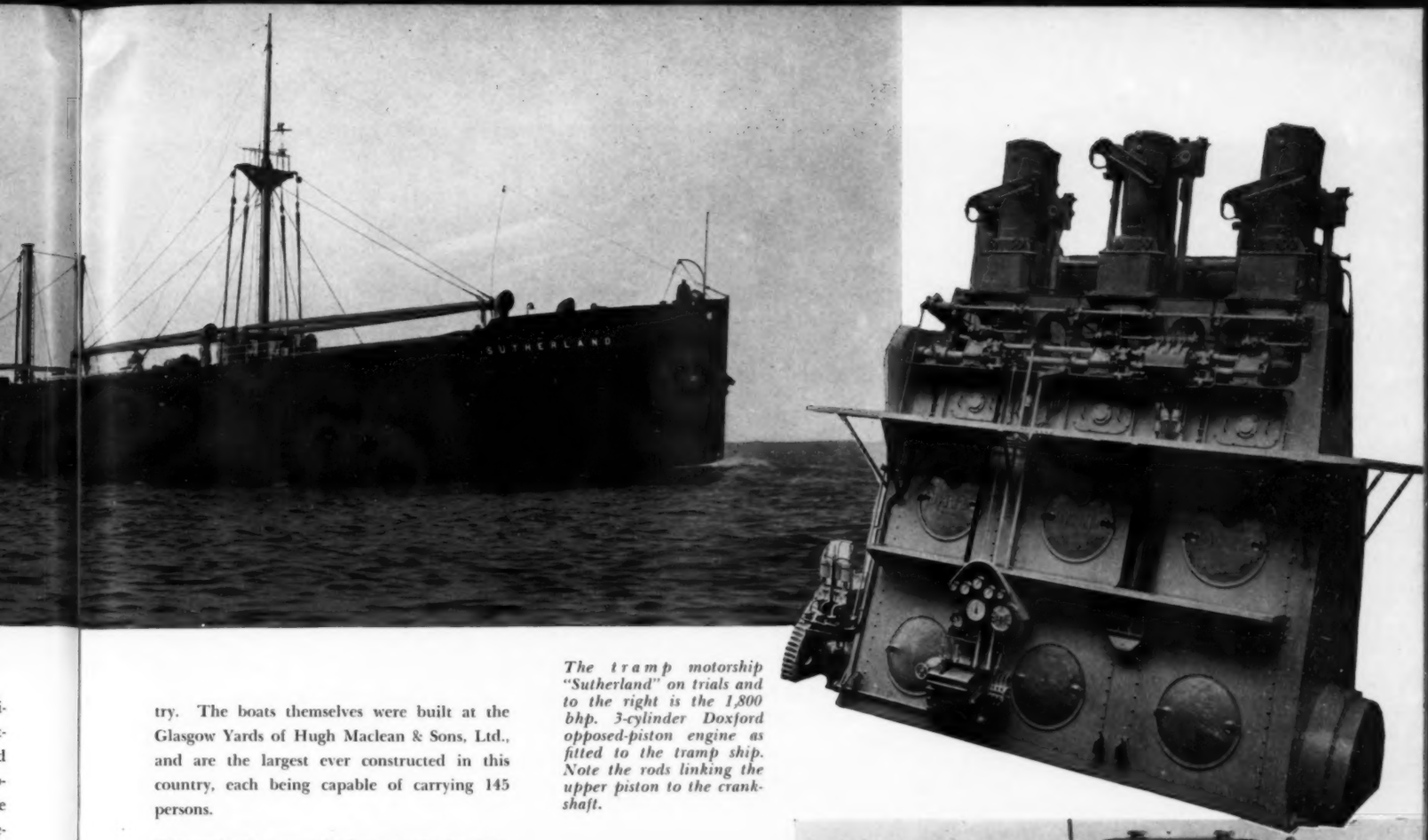
Length between perpendiculars	315 ft.
Breadth	45 ft. 6 ins.
Molded depth	28 ft. 10 ins.
Dead weight	3,050 tons

The vessel is of the two-deck class with additional fruit decks in the holds. She has a platformed bow and streamlined deck houses and funnel, and has been designed in order to obtain a maximum of speed at the lowest possible fuel consumption. The main engine is a nine-cylinder, two-stroke, single-acting, poppet-valve unit of Burmeister and Wain pattern, developing 4,500 ihp. at 160 rpm., the current for refrigerating power and lighting being applied by three auxiliary three-cylinder Diesels, also of Burmeister and Wain manufacture, coupled to 150 kv. 220 volt dynamos.

When the *Vibran* first went out on her trials, besides easily attaining the required fuel consumption, she also proved herself a remarkably fast ship. The maximum speed registered was 16.5 knots, which, for a vessel of this size and power is very good indeed. At present she is in regular service between Europe and the West Indies, warking to a 15½ knot schedule and carrying out her duties reliably and well.

Just as this report goes to press a highly interesting piece of information has come to hand. It concerns the Cunard-White Star Line's new wonder ship, the *Queen Mary* and her 24 lifeboats.

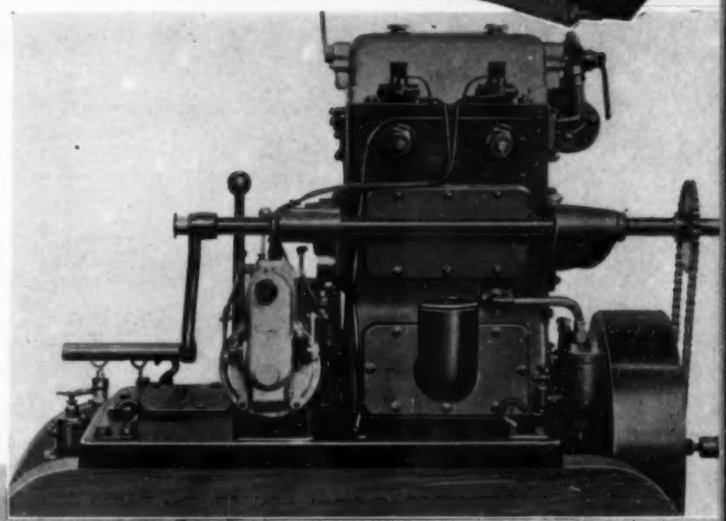
Although the *Queen Mary* is basically a turbo-electric ship, her designers have, nevertheless, had to give credit where credit is due, with the result that all her lifeboats have been equipped with Diesel engines. The company entrusted with the production of these engines was Messrs. John J. Thornycroft, one of the oldest and most renowned firms in the marine indus-



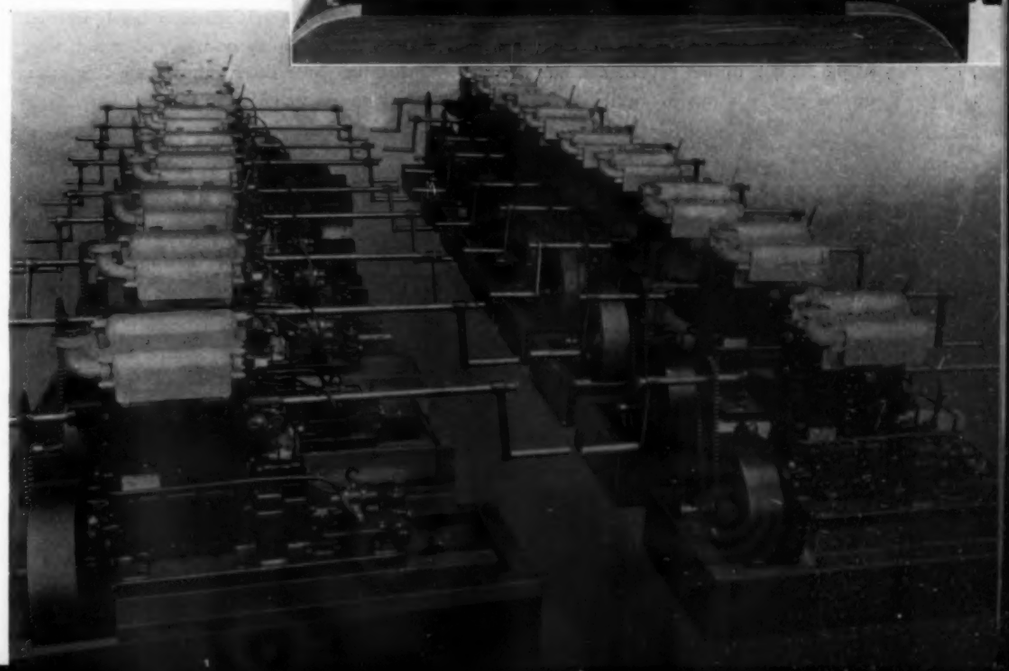
The tramp motorship "Sutherland" on trials and to the right is the 1,800 bhp. 3-cylinder Doxford opposed-piston engine as fitted to the tramp ship. Note the rods linking the upper piston to the crankshaft.

try. The boats themselves were built at the Glasgow Yards of Hugh Maclean & Sons, Ltd., and are the largest ever constructed in this country, each being capable of carrying 145 persons.

The engine is a two-cylinder unit of 4-ins. bore and 6-ins. stroke, developing 18 bhp. at 1,200 rpm. It has overhead push-rod operated valves, two per cylinder, a detachable cylinder head, flat topped five-ringed aluminum alloy pistons and cast iron dry cylinder liners. The fuel pump is mounted on the camshaft wheel housing, and is driven from it by a cross-shaft. Pintle type injectors are mounted vertically in the cylinder heads and spray into circular combustion chambers which connect with the cylinder by a specially shaped passage. An efficient fuel filter and governor are also fitted.

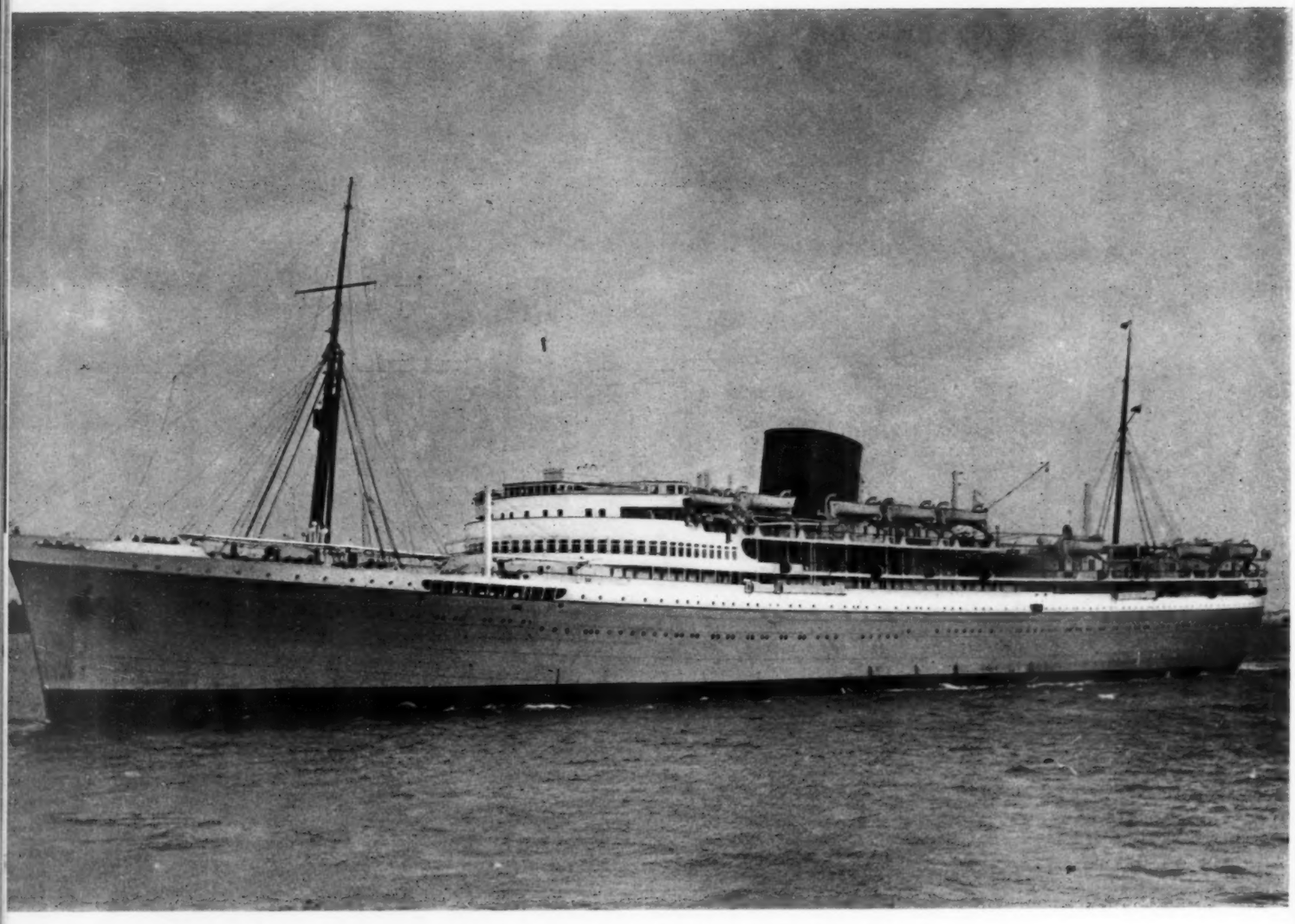


Thornycroft RF2 type Diesel engine and below a group of these engines ready for dispatch for installation in the lifeboats for the "Queen Mary."



In order to prevent damage in heavy weather, the whole of the power unit is enclosed in a watertight casing, the engine controls and starting handle being mounted outside. On the top of the casing, which is heavily insulated and heated by a non-flame type ¼ kw. heater, connected by a plug to the ship's circuit, are fitted a watertight hatch and an air inlet for the engine. Hand starting is employed, a feature being that the motor can be started up whilst the lifeboat remains in the davits and kept running whilst the craft is lowered into the water.

The testing of these engines was carried out under many extremes of maltreatment and overload, the severest tests of all relating to cold starting. In this connection units of the proposed type were placed in cold storage



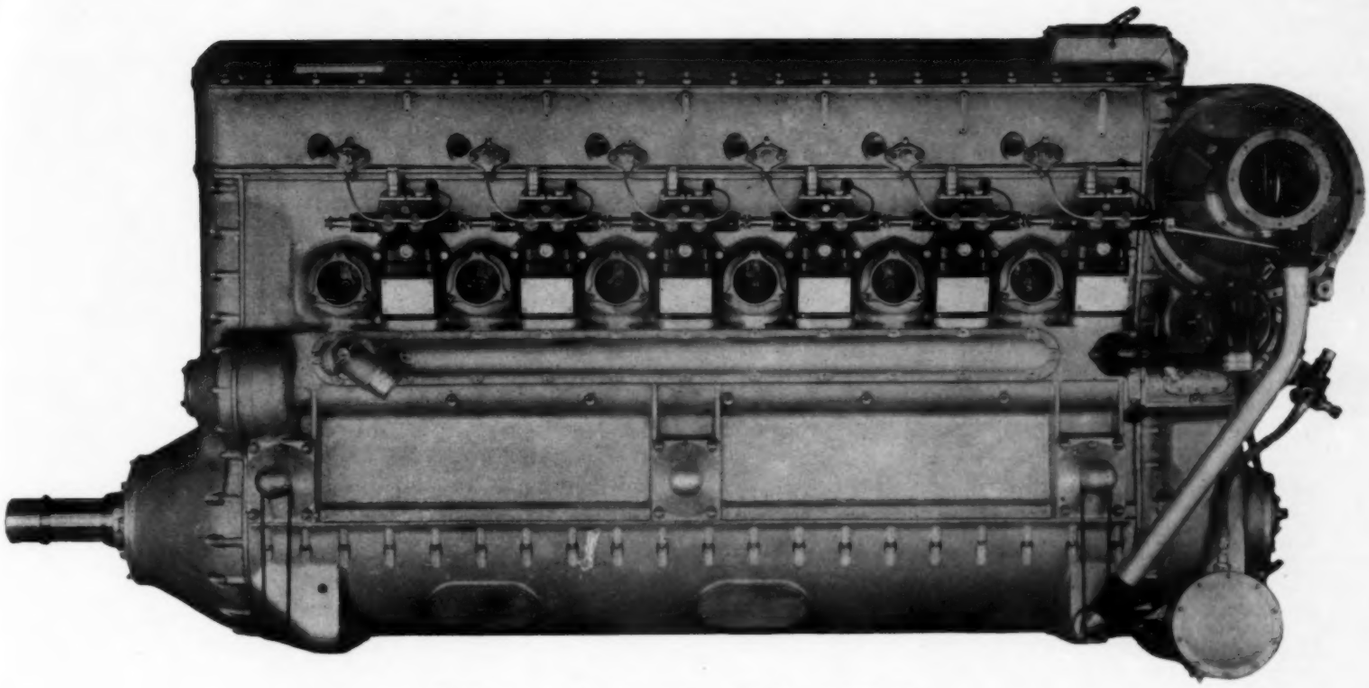
The R.M.M.V. "Stirling Castle," pride of the Union Castle Line. This is the highest powered British motor vessel yet built.

chambers for 24 hours in a temperature of 20 deg. F., and then cranked by hand. In every case they were running in less than thirty seconds. As a further experiment, one engine of this type was carried on the deck of the Cunard liner *Scythia* during a north Atlantic crossing, with the thermometer below freezing point, and on several occasions when tests were made the game little unit started at a turn, which speaks well for the Diesel.

INADEQUACY OF BRITISH MERCANTILE FLEET

THERE is a humorous side to the quotation immediately following from the March issue of *British Motor Ship* when the comparative situation existing in the American Merchant Marine and the British Merchant Marine is considered. If Great Britain is worried about the inadequacy of their mercantile fleet, we in this country should be having heart failure.

"A problem which needs to be examined in connection with national defence is the adequacy of the British mercantile fleet to meet our needs in case of war. The tonnage now sailing under the British flag is 2,000,000 gross less than it was when war broke out in 1914. Yet in 1917, consequent upon the submarine campaign, we were within measurable distance of losing the war because of our lack of tonnage." According to *British Motor Ship*, "the situation is all the more serious as 22 per cent of our freight-carrying tonnage is over 20 years old and, therefore, obsolete, whilst British cargo tonnage is diminishing in relation tc that of the rest of the world. For the five years 1931-1935 inclusive the average annual tonnage of ships launched in the United Kingdom was 356,000 gross. For the previous 25 years the average yearly tonnage was 1,325,000 tons gross. Whatever be the position of the world's shipping, this is a situation with which, from the standpoint of national defence, it is difficult to remain satisfied."



Deschamps Diesel, side view, 1200 hp. at 1600 rpm.

DIESEL AIRCRAFT ENGINES IN THE UNITED STATES

By PAUL H. WILKINSON

IN the Diesel aircraft engine field, the United States is at present trailing the field compared with the progress made abroad. This is partly due to our abundant supply of gasoline – which has to be imported into a number of European countries – and to our rapid development of the gasoline engine which has momentarily pushed the Diesel engine out of the picture. To this must be added the lack of standardization of Diesel fuel suitable for aircraft engines, placing us in a position similar to that which existed prior to the establishment of Octane ratings for gasoline.

Now that long-range flights, both commercial and military, are the order of the day, however, the attention of our aircraft manufacturers and airline operators is being focussed on the many advantages of the Diesel engine. More economical operation and reduction of the fire hazard are factors of sufficient importance to warrant further development without delay, if we are to compete on an equal footing with our European rivals.

We are now in the second phase of the development of the Diesel aircraft engine in the United States, whereas in Germany, for instance, development work has been painstakingly carried on by Junkers and Deutsche Lufthansa for a number of years. Our first Diesel engine for airplane use was produced by Packard in 1930, to the designs of the late Capt. Woolson. The Packard DR-980, which is shown in the illustration, was quite conventional in general appearance, being a nine-cylinder, radial, air-cooled engine. It was rated at 225 hp. at 1,950 rpm., and weighed 510 lbs., or 2.26 lbs. per hp. The bore and stroke were 4.81 ins. and 6.00 ins. respectively, giving it a total displacement of 982 cu.ins. It operated on the four-cycle principle.

Several novel constructional features were embodied in this engine. The air-cooled cylinders had integral heads and were attached to the one-piece barrel crankcase by two steel hoops tightly drawn around the flanges at the front and rear of the cylinders. Pivoted counterweights with strong compression springs were used on the two-piece crankshaft to ensure smooth operation. A flexible propeller drive was provided whereby the propeller hub floated on the front end of the crankshaft and was driven through rubber blocks attached to an arm splined to the crankshaft. A single valve in the cylinder head served for both inlet and exhaust.

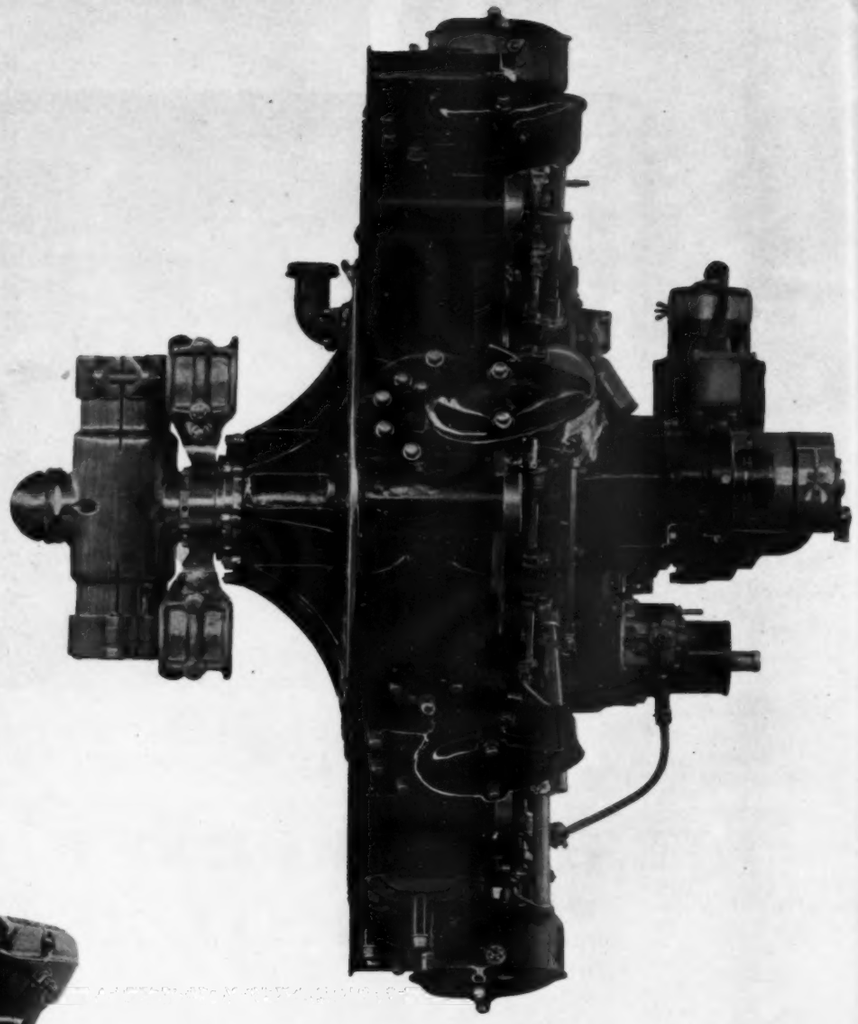
The injection system operated at a pressure of 2,500 lbs. per sq.in., and fuel was supplied to each cylinder by individual fuel pumps and injectors. The fuel oil used was of Specific Gravity 0.840, and the consumption was 0.40 lbs. per hp. per hour.

A number of these engines were built and achieved quite good results in various small airplanes. At one time, the World's Non-Refuelling Duration Record was held by a Bellanca airplane equipped with this engine, the duration of flight being over eighty-four hours.

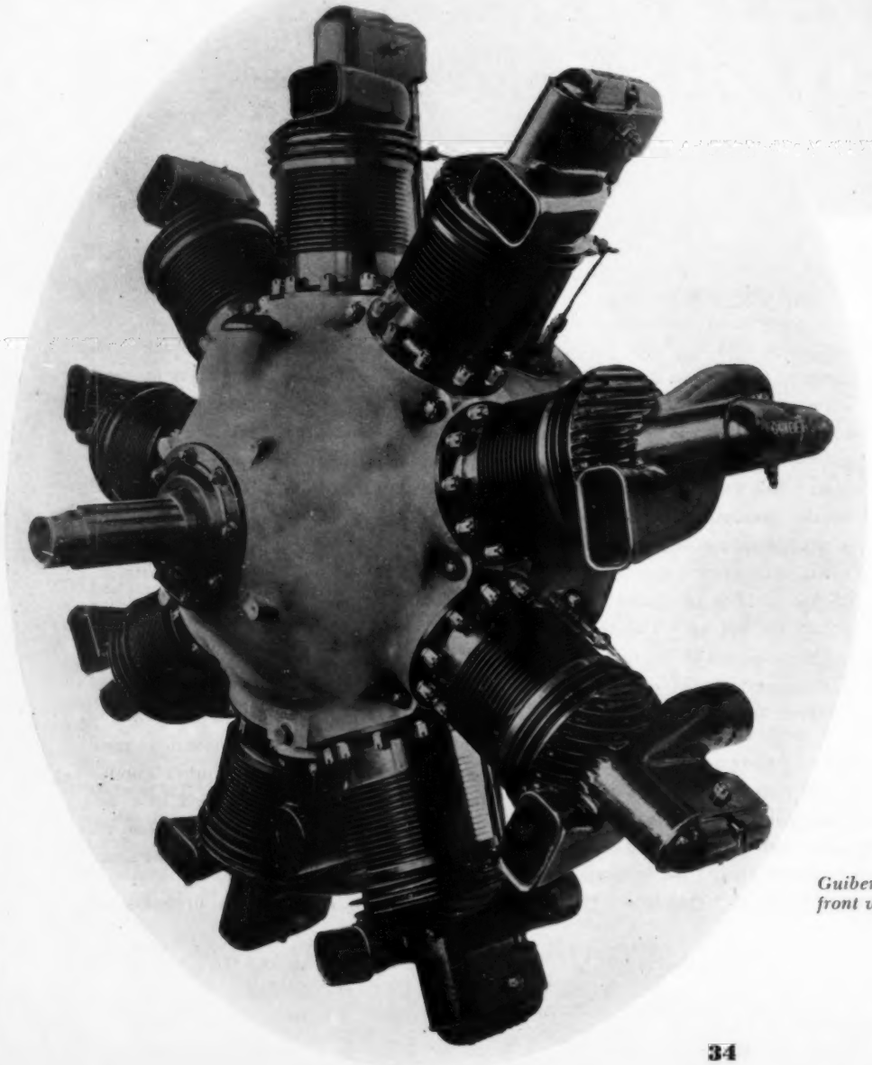
The Guiberson nine-cylinder air-cooled en-

gines, produced in 1931, were similar to the Packard engine in general appearance. The Guiberson A-918, which was regarded as an experimental engine, had a bore and stroke of 4.75 ins. and 5.75 ins. respectively, and a displacement of 918 cu.ins. It was rated at 230 hp. at 2,000 rpm., and weighed 530 lbs., or 2.30 lbs. per hp. The better known engine, the Guiberson A-980, which is shown in the illustration herewith, was of the same bore and stroke as the Packard engine, and was rated at 185 hp. at 1,925 rpm. It weighed 509 lbs., equivalent to 2.75 lbs. per hp. It was granted A.T.C. No. 79 by the Department of Commerce, and saw considerable service in flight in small airplanes. Recently, a Guiberson engine was supplied to the United States Navy, Bureau of Aeronautics, for test.

Another air-cooled radial engine appeared in 1932. This was the Aviation Diesel, designed by John H. Suter, which was a seven-cylinder engine operating on the four-cycle principle.



Packard DR-980, side view, 225 hp. at 1950 rpm.

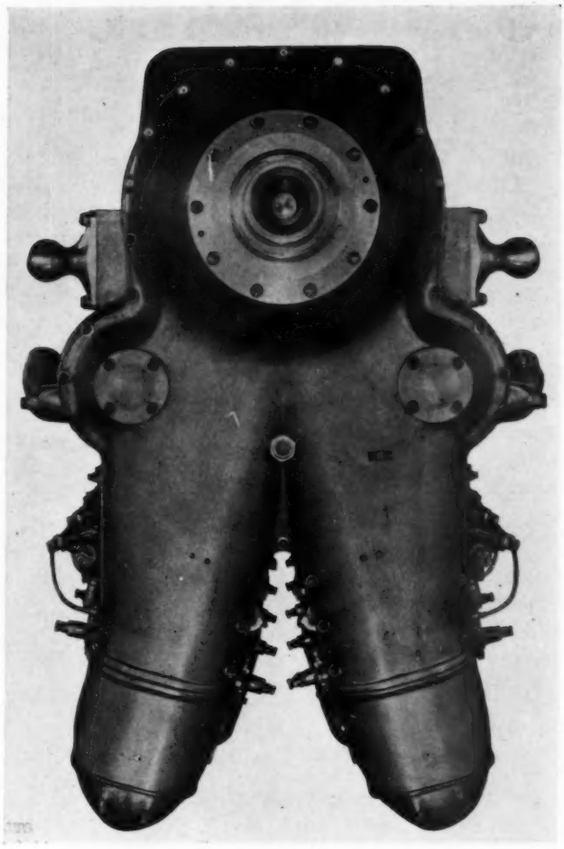


Guiberson A-980, three-quarter front view. 185 hp. at 1925 rpm.

It was rated at 400 hp. at 1,500 rpm. and weighed 1,390 lbs., or 3.47 lbs. per hp.

In 1934 a considerable stir was caused in the aeronautical world by the appearance of the Deschamps Diesel. Built to the designs of D. J. Deschamps by the Lambert Engine & Machine Co., it constitutes our most advanced type of engine for large aircraft today. Its twelve cylinders are arranged in two banks below the crankcase. Prestone is used as the coolant. It operates on the two-cycle principle.

Front and side view of the Deschamps engine are shown herewith. The cylinder banks are inclined at 30 degrees, which makes a most compact arrangement and reduces the frontal area to 9.12 sq.ft., which is very small for such



Deschamps Diesel, front view, 1200 hp. at 1600 rpm. Frontal area 9.12 sq. ft.

a powerful engine. Two inlet valves are provided in each cylinder head, and the exhaust ports are arranged around the cylinder walls. Air for scavenging is supplied by two General Electric superchargers mounted at the rear of the engine and driven through gearing at 13.5 times crankshaft speed. At 1,600 rpm., the air pressure is 12 lbs. per sq.in., and as only 8 lbs. per sq.in. is required for scavenging, there is a pressure of 4 lbs. per sq.in. available for supercharging.

A dual ignition system is provided by Deschamps duplex fuel pumps for each cylinder, the pump elements being operated alternately by cams set at 180 degrees on a camshaft driven at engine speed. For slow running, one pump element on each cylinder can be cut out, so that even firing is maintained as the engine then operates on the four-stroke principle. This has the advantage that all the cylinders are heated for instant acceleration. An injection pressure of 3,500 lbs. per sq.in. is used.

The bore and stroke of the Deschamps Diesel are 6.00 ins. and 9.00 ins. respectively, making the displacement 3,052 cu.ins. It is rated at 1,200 hp. at 1,600 rpm., this power being maintained to an altitude of 10,000 ft. Its weight is approximately 2,400 lbs., or 2.00 lbs. per hp.; but it is estimated that ultimately this could be reduced to 2,115 lbs., or 1.76 lbs. per hp. The B.M.E.P. is 98 lbs. per sq.in.

The injection, scavenging, lubrication and cooling systems for each bank of cylinders are independent of each other, so that the engine can be operated on one bank of cylinders if necessary in an emergency.

With slight modifications and additional supercharging, which would increase the engine speed considerably, the output of the Deschamps Diesel could undoubtedly be increased to 1,500 hp. without much difficulty. This would provide an engine of sufficient power for the 100,000 lb. trans-Atlantic flying boat outlined in the letter from Glenn L. Martin which appeared in the February issue of DIESEL PROGRESS – and it would be of all-American design and manufacture. Four of these engines, giving a total of 6,000 hp., would make the power loading 16.6 lbs. per hp., which is a reasonable figure for this type of aircraft.

In the Twentieth Annual Report of the National Advisory Committee for Aeronautics to Congress, 1934, the early development of Diesel aircraft engines was advocated, particularly where engines of greater power are required. Extensive research work was said to have been done relative to two-cycle and four-cycle Diesel engines, fuel injection systems, combustion chambers and Diesel fuel, which was resulting in a number of most promising developments. And at the annual meeting of The Institute of the Aeronautical Sciences last February, Dr. George W. Lewis, Director of Research of the N.A.C.A., emphasized the importance of Diesel engine development, especially with regard to the economical operation of trans-Atlantic flying boats.

Diesel engines are admirably suited for use by American airlines, for both trans-continental and trans-oceanic service. Not only would considerable reduction in operating costs be possible, but the reduction of the fire hazard would greatly add to the confidence and enjoyment of the passengers, and safeguard the valuable equipment of the airlines. The Government at last is apparently aware of the advantages of the Diesel aircraft engine for long-range flights, and experimental engines are under construction by Godfrey for the Army Air Corps, and by Lawrance for the Bureau of Aeronautics. Work is also being done in connection with the Lanova Combustion System which offers distinct possibilities for adaption to aircraft engines on account of its low operating pressures. It is to be hoped that our Diesel aircraft engine industry will now be assisted in every way possible, so that our aircraft can compete on equal terms with the products of European countries over the airlines of the world.

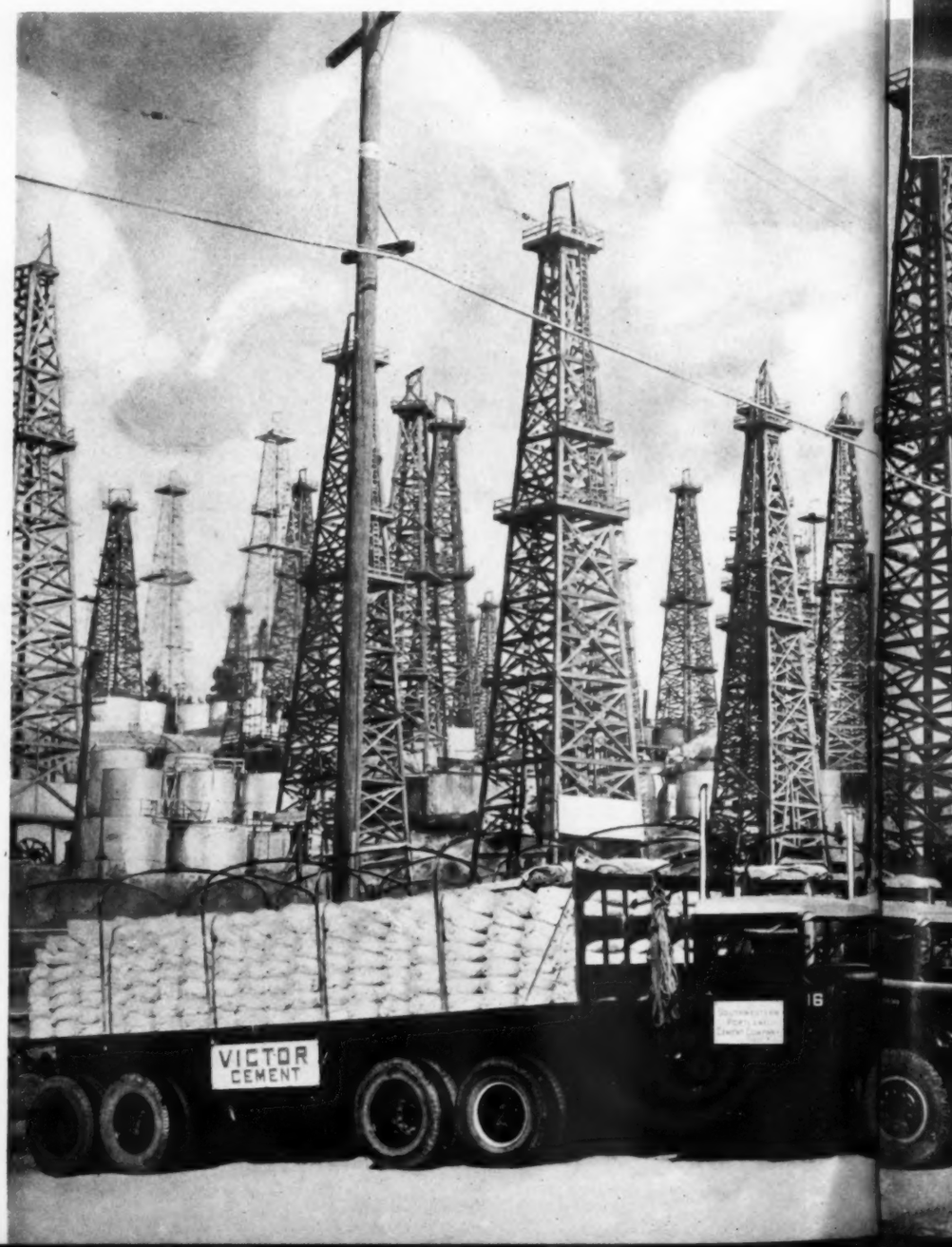
It is true that as airplanes increase in size, larger payloads – in the form of passengers – can be carried. But it is also true that considerably greater quantities of gasoline must be carried for the engines, in close proximity to these passengers and the crew of the airplane. Large airliners are costly to build and operate. There are therefore plenty of good reasons why the Diesel engine should be developed for use on the multi-engined airliners which are making their appearance for both day and night operation over our airlines. The United States has built up a marvelously efficient system of air transportation – it can likewise lead in safety and economical operation by adopting Dieselization.

CEMENT GOES DIESEL

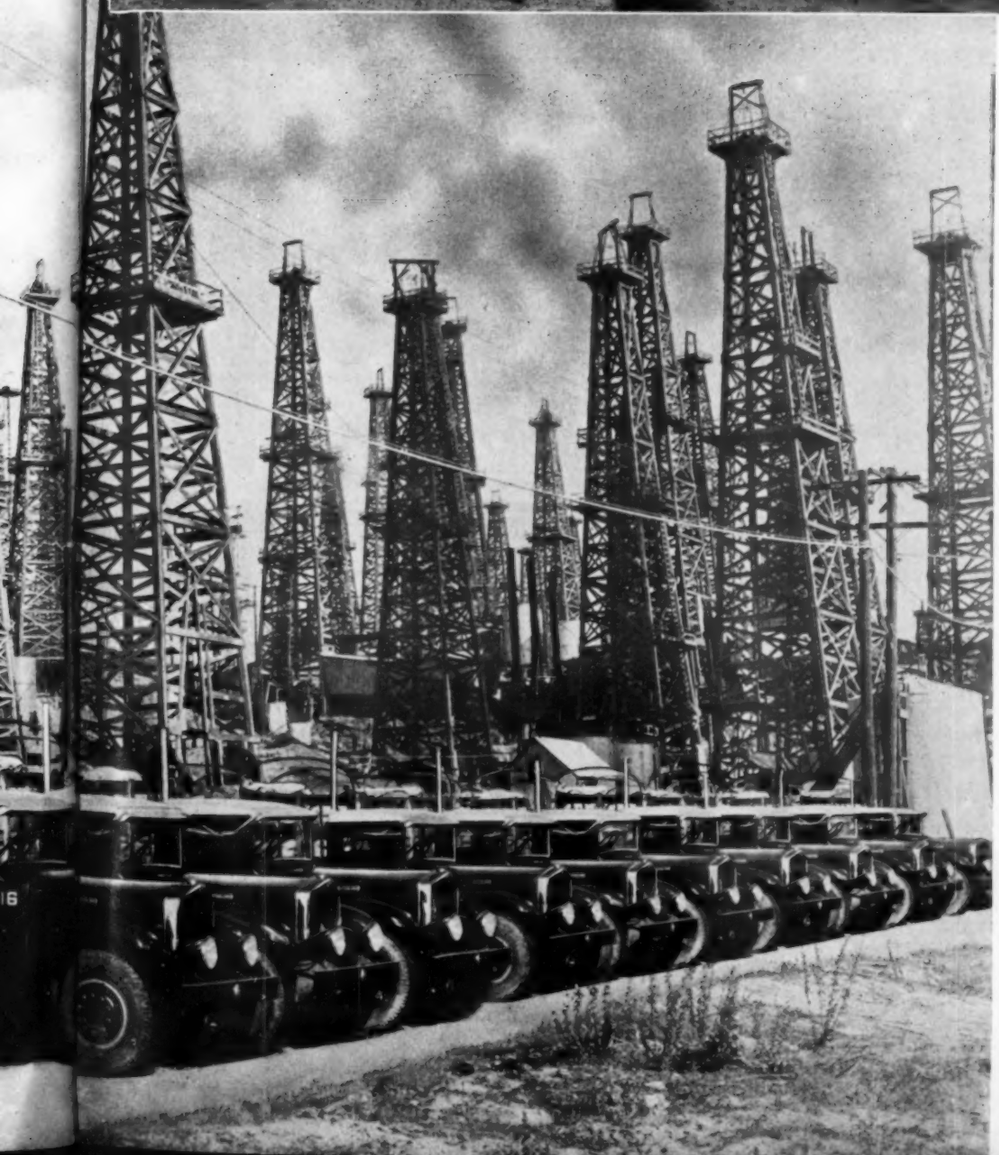
By ARMELDA BARCLAY

A REAL romance in transportation has been enacted in Southern California. The plot involves the transportation of cement from four manufacturing plants, two of which are located sixty miles from Los Angeles, known as the inner mills, the other one hundred miles from Los Angeles and known as the outer mills. Going back ten years, all cement was shipped by rail at "all the traffic will bear" rates plus additional cartage from rail point of delivery to the job. With the use of motor trucks it was found that deliveries could be made direct to the construction job without rehandling. This advantage in favor of trucks forced the rails to reduce their rates from 12 cents per hundred from the outer mills and 9 cents from the inner mills to 7 cents and 5 cents. The use of trucks continued to the point where the railroads were frantic over lost tonnage and a further reduction of rates to 5½ cents and 3½ cents respectively was announced by the rail carriers. Here the Sterling Diesel tractor and semi-trailer makes its entrance. The Southwestern Portland Cement Company, one of the outer mills, being faced with a freight differential of 2 cents per cwt. over their competitors, the inner mills, saw a chance to wipe out this differential with Diesel-powered trucks, operating from their mill at Victorville, California, to Los Angeles, a distance of 100 miles, and other points. That the original purchase of 4 units has been increased to a fleet of 10 Sterling tractors would indicate a satisfactory operation.

On February 2, 1935, four Sterling Diesel tractors and semi-trailers were put into operation hauling cement in bags to Los Angeles and other points in Southern California. The location of the Victorville plant on the Mojave Desert makes it necessary to pull all loads, going to Los Angeles and all other points south including Imperial Valley, over Cajon Pass—whose summit elevation is 4300 feet. From the Victorville Mill to Cajon summit, a distance of 16 miles and a constant grade, these Diesel tractors average 55 minutes running time. While this is a long grade and a test of motor stamina, especially when the desert temperatures reach 120 degrees, the real test of Diesel superiority comes when the tractors drop down the other side of the mountain to San Bernardino. This 18 miles of down hill work not only puts greater strain on motor bearings holding back the load than pulling it. There is also the item of motor temperature to consider. Since Diesel motors operate at much lower water temperature in extreme desert heat than gasoline power, the quick change from the hard pull of a long grade in desert heat on one side of the mountain to a longer run down hill in much lower temperature does not affect the Diesel motor—while with the gas motor, Cajon Pass could be called a bearing graveyard. One of the popular criticisms of Diesel power, voiced by those not in "the know," that Diesel motors will not help hold back a load going down hill—is disproven by this fleet of trucks, whose brake life average is better than 50,000 miles, using fabric lining, and without the help of the motor this figure would be cut in half. Seventy-five per cent of all loads go over this pass and the balance



Sterling Diesel tractor crossing the Mojave desert with 19 tons of Victor cement.



Ten Sterling Diesel tractors and semi-trailers making an overnight delivery of Victor cement to the oil fields. All ten units equipped with Cummins Diesels.

are routed to the San Joaquin Valley via the famous Ridge Route, where the conditions are even less favorable.

Tractor number 10, 12, 14, and 16 finished their first year's service on January 31, 1936, with a total mileage of 431,659 miles, or an average of 107,914.75 miles each. The consistent performance of these four Diesel motors operating over the most severe routes, where extremes in temperatures, altitude and gradient are encountered on every trip made should convince the most skeptical person that Diesel power is superior to any for highway transportation. It is true that these units have been serviced in a systematic way, and given thorough supervision, in operation, but after all if property is worth having, it is entitled to proper care and the owner who neglects the essentials in truck operation pays for his folly.

The operating range of these units was found to be a top speed of 33 mph. with the motor speed from 1350 to 1550 rpm. A check of the

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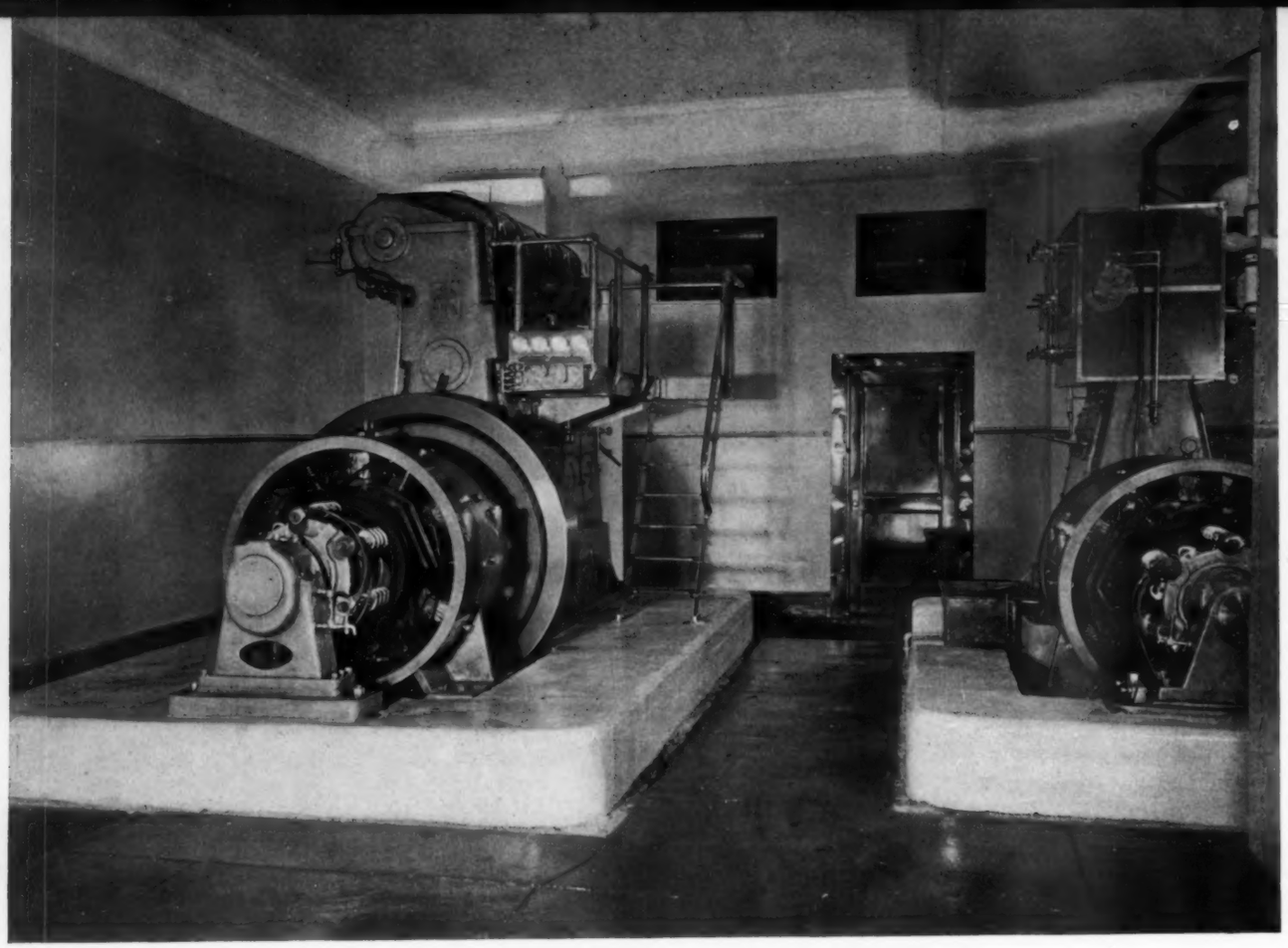


The engine room of the Ice Club. Below: Mr. Harry J. Smith, Supervising Engineer, standing beside his Ingersoll-Rand Diesel.

OLYMPIC SKATERS AND DIESELS

By EVERET B. KANE

MARIBELLE VINSON, National Woman Amateur Figure Skating Champion and 1936 Olympic contestant undoubtedly gives very little, if any, thought to Diesel engines or the Diesel industry. Her superb grace and skill contrast strongly with the rugged strength and prosaic purpose of the Diesel. Yet there is one common and vital link involved, namely, ICE. Smooth, glittering ice for Miss Vinson's sharp skates; dependable ice for constant practice, inexpensive ice, that it may not be an unattainable luxury; and, providing this necessary but unstable commodity, is a Diesel engine.

Eight years ago on the corner of Eighth Avenue and Fiftieth Street, New York City, adjoining the famous Madison Square Garden, the Ice Club first opened its rink to skaters. Since then thousands of men, women and children, professionals and amateurs, novices and experts, have donned their skates to enjoy this broad expanse of ice in the heart of Manhattan. In addition to the regular public sessions every evening and Saturday, Sunday and Monday afternoons, it is also the headquarters for the Skating Club of New York, the Junior Skating Slub, Manhattan Figure Skating Club and other such private skating organizations.

The rink which measures one hundred and ninety by eighty feet is on the roof of the building and glass enclosed on three sides. In addition there is a large skylight which insures an abundance of fresh air and sunshine.

Miss Maribelle Vinson, National Woman Amateur Figure Skating Champion. The Ice Club rink in the background.

The Ice Club has been the scene of many national and international championships. In 1930 it was selected to skate the "school figures" of the world's championships. The texture of the ice during these title events brought warm words of praise and commendation from such stars as Miss Sonja Henie of Norway, Karli Schaefer of Austria, Ernst Baier and other European contestants. Incidentally, this is also the home club of Miss Maribelle Vinson, previously mentioned, Miss Katherin Durbrow, who took first place in the Junior Championship recently held in Boston, and Miss Audrey Pepe, another member of the 1936 United States Olympic Team.

In a recent survey of thirty-five skating rinks throughout the country, the Ice Club was adjudged the most modern, comfortable and best-conditioned artificial ice rink in the United States.

So far as the Diesel application to this interesting and unusual service is concerned, the story told by Mr. Harry J. Smith, Supervising Engineer, is a familiar one. Electrical power for building lighting and operating the various compressors, pumps and machinery incident to ice manufacture was first purchased from a commercial utility company. The cost was the major factor of expense and in 1935 ran higher than three and one-quarter cents per kilowatt hour.

Believing that material saving could be effected for his principles by means of a Diesel, Mr. Smith gave the problem serious thought for several years and evolved a plan so thorough in every detail and so conclusively economical that it was adopted and carried out.

Since the situation involved not only electrical power but also steam for heating the building, the solution took the rather unique form of a combination steam and Diesel plant. One low pressure heating boiler was replaced by a new high pressure, oil burning boiler supplying steam to a three cylinder Ames reciprocating engine. This unit carries the regular power load during winter months in proportion to the demand for heating steam. During this period of the year the Diesel carries the balance and is cut into the line each evening when lighting creates a peak load. In the summer the steam plant is shut down completely since no building heat is necessary and the Diesel assumes the full load. Hot water is then supplied from the Diesel cooling water in ample quantity for all tenants of the building. Both the steam and Diesel engines are directly connected to 150 kw. Crocker-Wheeler generators.

The Diesel selected by the Ice Club is a 4-cylinder Ingersoll-Rand rated at 225 hp. at 360 rpm. It is the solid injection, 4-cycle type with an 11 in. bore and 18 in. stroke. On October 5, 1935, the Diesel first assumed the load and figures show that for the months of November, December and January electric current was generated for approximately three-quarters of a cent per kilowatt hour, a very impressive and substantial saving. Mr. Smith estimates that the entire cost of installation will

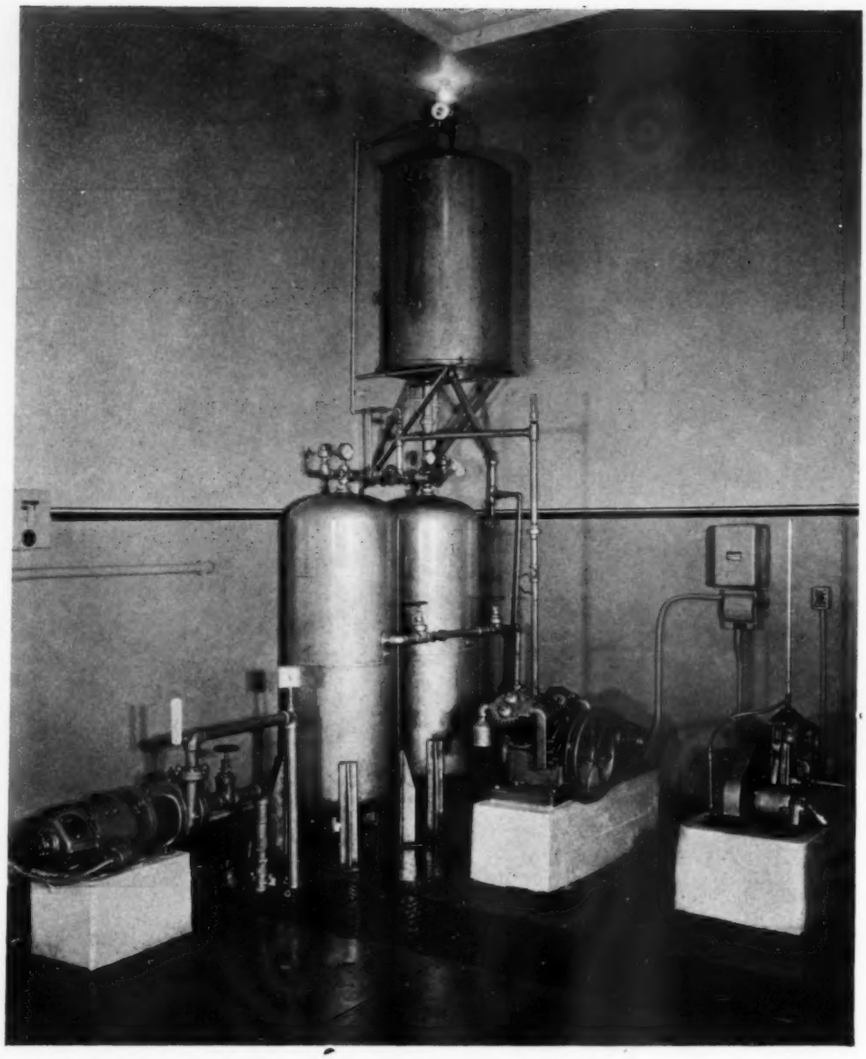
be amortized out of power savings in three and one half years. A word of explanation regarding this low current cost should be noted, however. In addition to the excellent economy of the Diesel it was necessary to increase the existing engine room personnel by one engineer so that only a small labor charge is included in the above figure.

In evidence of the time and study given this entire installation, one need only see the engine room and note the compact layout, the absence of unsightly piping and the efficient arrangement of all units, both main and auxiliary. Further, and perhaps even more conclusive proof of excellent design and workmanship is the utter lack of vibration either at the ice rink or elsewhere in the building, partially resulting from a quiet running engine to start with and partially due to a layer of cork insulation under the concrete bed.

Noise, likewise, has been eliminated by use of Maxim silencers on both exhaust and air intake lines. On the latter an American Air filter insures clean air reaching the combustion chambers. The Diesel is further protected by a De Laval fuel oil purifier. To complete this outstanding power plant, two Neptune meters have been installed to measure the consumption of fuel oil, one on the steam boiler burners and one on the Diesel fuel line. This removes the necessity of a tank measuring stick or calibrated glass gauge, the first being troublesome to use and the latter none too accurate.

At the time of installing the new power plant the management also completely redecorated and overhauled the rink itself. Ten miles of welded pipe were laid on top of concrete so that the water is in direct contact with the pipe. Since the rink is never required for any other purpose than skating this can be done and does provide faster freezing as well as considerably smoother and better ice.

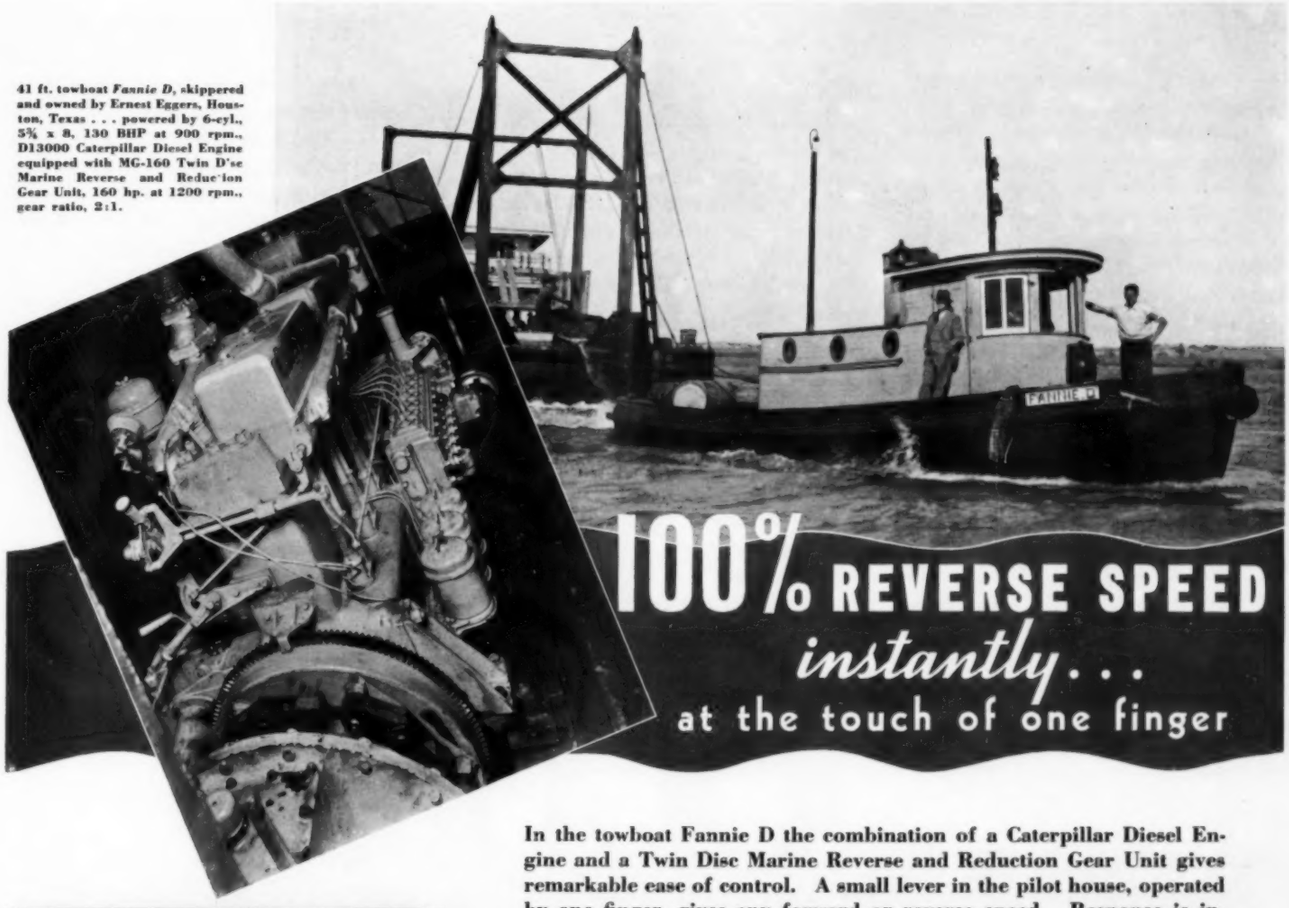
At this point it might not be amiss to discuss briefly the general appearance of the engine rooms. Chief Operating Engineer Charles Miller is to be congratulated upon such a spick and span domain. Certainly no housewife ever kept her living room more spotless and orderly. Fresh paint covers walls and floors, all engines and equipment are free from dirt, grease and dust and these factors, coupled with a minimum of visible piping, give a most cheerful and orderly effect. While the above points may seem superfluous to a Diesel power plant, it is common knowledge in the industry that when a man requires such exacting standards of general cleanliness to be maintained, the mechanical condition of the equipment under his supervision is almost certain to be in A-1 shape, as is the case at the Ice Club.



A corner of the engine room showing starting air tanks, Ingersoll-Rand compressor, De Laval fuel oil purifier and Ingersoll-Rand circulating water pump.

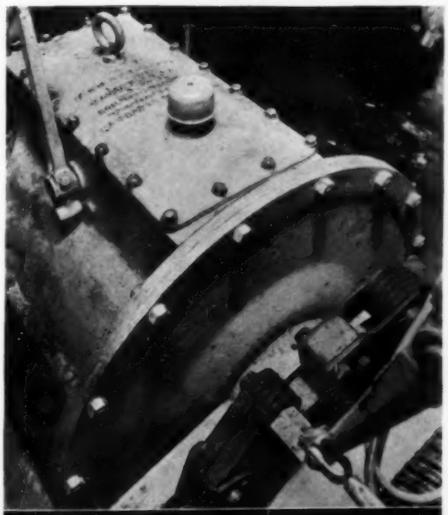
Chief Miller has three assistant engineers so that working on eight-hour shifts one man is on duty at all times, each man has one day a week relief and for three days each week there are two men on duty during the daytime shift, one for operating and one for whatever general repair and maintenance may be required.

With the advent of stream-lined Diesel trains the public consciousness has been aroused regarding this type of prime mover. Most of the attendant publicity, morover, stressed Diesel economy. While the low cost of operating Diesels is a major economic factor, one should not overlook the equally important point of dependability. The Diesel engine at the Ice Club was purchased with the full knowledge that it would have to operate continuously throughout the summer months with the steam elements of the installation completely shut down. As evidence of the confidence placed in the Diesel unit no breakdown contract was placed with the local power company regardless of the fact that it would take several hours to fire up the boiler, assuming that it or the steam engines were not being overhauled, which is quite possible. The Ice Club has solved its power problem and this plant is one of the most interesting Diesel installations in the vicinity of New York City.



41 ft. towboat *Fannie D*, skippered and owned by Ernest Eggers, Houston, Texas . . . powered by 6-cyl., 5¾ x 8, 130 BHP at 900 rpm., D13000 Caterpillar Diesel Engine equipped with MG-160 Twin Disc Marine Reverse and Reduction Gear Unit, 160 hp. at 1200 rpm., gear ratio, 2:1.

100% REVERSE SPEED *instantly . . .* at the touch of one finger



In the towboat Fannie D the combination of a Caterpillar Diesel Engine and a Twin Disc Marine Reverse and Reduction Gear Unit gives remarkable ease of control. A small lever in the pilot house, operated by one finger, gives any forward or reverse speed. Response is instantaneous . . . the boat handles easily even in tight places, without effort on pilot's part.

The Twin Disc Marine Reverse and Reduction Gear differs materially from conventional type conversion units—being unusually simple in design—two clutches . . . five gears . . . with large size, extra capacity anti-friction bearings throughout.

Clutches are close coupled, multiple disc type . . . operating in oil. Reduction unit is built into reverse gear. When operating in reverse and through the reduction gears, only two pairs of gears (one pair spur and one internal set) are in operation. When in forward speed only one pair are operating under load. *Reverse speed is 100%* of forward speed. Gear operation is remarkably quiet, due to the use of helical gear. A continuously operating oil pressure pump (after providing pressure for operating mechanism) forces oil to clutch plates, gears and anti-friction bearings. Gear case acts as an oil sump. Oil supply is independent of engine.

MG-160 "Series" Reverse and Reduction Gear Units are rated 160 hp. at 1200 rpm.; standard gear ratios are 2:1 or 3:1. *Bulletin 103* tells how this Twin Disc unit adapts any standard gasoline or Diesel engine for marine service. *Write for it.*

TWIN DISC CLUTCHES

TWIN DISC CLUTCH COMPANY

1343 RACINE STREET — RACINE, WISCONSIN

TWIN DISC MARINE REVERSE AND REDUCTION GEARS

CEMENT GOES DIESEL

. . . . *Continued from page 37* . . . .

time cards showed average running speed of 21.8 mph. for the entire 431,659 miles. When these units were put in the shop at 100,000 miles for a general overhaul the only motor replacements necessary were piston rings. Only standard size rings were used – since the greatest clearance shown on any cylinder liner was 9 thousandths – the average being 6 thousandths. The only previous work done on these motors was a valve grind each at 75,000 miles. The choice of fuel is the most important single factor in Diesel operation. Fuel used by this fleet was supplied by the Union Oil Company and serviced at their Los Angeles station at 4 cents per gallon. Lubricating oil is also important. Triton S.A.E. 30 has been used throughout and changes regulated by laboratory test – every other change of oil being sampled and analyzed by Faber Oil Testing Service – the average mileage per change is 1,750 miles.

This entire story can be said with figures and since accountants differ as to the best system of keeping records, there can be no system that prevents bills from having to be paid – so here is the actual cash paid, or out-of-pocket cost, to operate these four tractors and semi-trailers hauling 400 bags of Portland cement per load, a total of 431,659 truck miles, showing the average cost per truck mile for each item.

Insurance, License and Taxes	$ .0053
Wages	.0441
Diesel Fuel 7.06 miles per gal. @4 cents	.0059
Lubricating oil, grease and materials	.0058
Repair parts and labor	.0051
Tires and repairs	.0009
Miscellaneous, fines, cargo loss, etc.	.0007
Total out-of-pocket cost per mile traveled	$ .0678

$ .0678 per mile x 200 miles round trip – $13.56
$13.56

19 tons x 100 miles
= $ .00713 total out-of-pocket cost per ton mile to transport cement in 400 bag loads from Victorville to Los Angeles.

The principal factor responsible for this very low cost of transportation is Diesel fuel – with an average of 7.06 miles per gallon at 4 cents we have a cost per mile of $ .0056. Then $ .0056 x 200 miles = $1.12 fuel cost per each round trip. Since the trucks return to the mill empty, the fuel cost per ton mile would be –

$1.12
1900 ton miles
= $ .00058

This fleet now consists of ten units, each averaging 10,000 miles per month, operating night and day over California's heaviest traveled highways, without a major accident, is indeed a tribute to both the owner and the manufacturer of this equipment.

FREEPORT, LONG ISLAND

. . . . *Continued from page 19* . . . .

pins are secured to the tops of the piston rods, and provide for a bearing the full length of the pin on top. The bearings for the pin are carried in a separate casting bolted to the piston head. Thus an unpierced piston skirt is possible and there is no danger of piston distortion from the wrist pin.

The solid injection system is of the Hesselman type. Cam operated individual fuel injection pumps are used and the control is by the spill bypass system. The hydraulically operated spray valves in the cylinder heads have membrane type spring loaded needle valves. Multihole nozzles distribute the fuel jets in the combustion chamber. These engines give a fuel economy of 8 to 10 per cent greater than the earlier type air injection engines.

There is very little industrial load on this station and the load changes come gradually. The engines with standard governor equipment maintain a frequency sufficiently uniform for the satisfactory operation of electric clocks in the village. As a standard for comparison, there is in the station a master clock which is checked by Western Union.

Exhaust temperature readings for all cylinders of engines 7 and 8 are recorded on a common board installed by the Brown Instrument Company, which is so complete as to deserve special attention at this point.

The following pyrometer equipment is installed in duplicate for each of the 3,000 hp. units.

A drum type electric recording pyrometer for exhaust temperature on each cylinder. An instantaneous reading pyrometer for each of the ten cylinders controlled by a small panel of ten toggle switches corresponding to the cylinder numbers. A resistance thermometer indicating intake and outlet temperatures for lubricating oil and jacket cooling water.

In addition to this panel for the engines, there are elsewhere in the station a recording liquid level instrument, measuring the water level in the cooling tower and two circular 24-hour recording instruments, the first for cooling tower water temperature and the second a wet and dry bulb hygrometer. The water level in the tower is held between 27 and 28 inches. As a safety precaution the liquid level instrument is connected to an alarm signal which furnishes the operating engineer with ample warning in case the water level drops to a dangerous level.

It is evidenced from the description that this pyrometer installation is so thoroughly complete as to make necessary temperature information instantly available. In addition the intricate wiring and engineering layout of the panel and instruments makes it one of the most compact set-ups of this type as applied to Diesel power plants.

Freeport enjoys an overall station economy of about 12 kw. hours per gallon of fuel used. Total production costs run just over 1 cent per kw. hour. Every addition to the station plant since 1920 has been paid for out of earnings. There are some bonds outstanding, but they were issued prior to 1920 and legal complications prevent retirement before maturity several years hence in spite of cash reserves on hand sufficient to pay them off completely at the present time.

The remarkable success of the Freeport municipal Diesel lighting plant and its present enviable position among such similar installations is due in no small measure to Mr. John F. Cotter, General Manager. Mr. Cotter's intelligent supervision in maintenance and operation together with his accurate system of cost accounting are to be commended and have contributed very vitally to the reduction of electric rates in Freeport.

INTERESTING DEVELOPMENT FOR DIESEL STARTING

THE Edison Glow Plug shown above is designed for use in full Diesel compression ignition engines. In starting a cold motor difficulty is frequently experienced, since the cold engine will abstract a considerable amount of heat, with the result that when the fuel is injected late ignition with partial combustion will occur, or no ignition at all. Partial combustion means eventual cylinder corrosion, while late ignition will result in hammering and damage to bearings.

These starting difficulties are overcome through the use of this plug, as it is its purpose to maintain a proper temperature during the starting period in the combustion chamber. This is accomplished by the passage of suitable electric current through the resistance coil. The resultant heat insures rapid combustion when the fuel oil is injected.

The Edison Glow Plug is of the double electrode type, involving a distinctive design that permits greater efficiency and quicker starting. The plugs are wired in series to a 24-volt battery with a resistance indicator and switch in the circuit. The indicator switch, located on the dash, acts as a pilot for starting. The operator throws on the switch, which heats the coils of the plugs to 2,000 degrees Fahrenheit in from 15 to 30 seconds. At the end of this period, when sufficient heat has been attained,

the starting pedal is depressed and the engine starts.

It is of vital importance not to have the resistance coil placed in a direct path of the oil spray, as rapid corrosion will set in. The resistance coil of the glow plug should not project into the combustion chamber if possible in order to be protected from the action of the burning gases. The life of the glow plug is also affected by the way it is used, and care should be taken when the current is switched on for 15 to 30 seconds to shut same off again as soon as unaided ignition occurs. If the current is left on for any length of time after starting, the life of the resistance wire will be materially reduced. When these plugs are installed in the proper position in the combustion chamber of a Diesel motor and treated fairly, long life can be expected.

The plug is so constructed that if the resistance coils burn out they can be replaced for a small charge, thus making the unit as good as new and eliminating the need for replacing the entire plug. Space has been left between the last coil and the center electrode for the swedging operation that holds the coil in place and also makes the coil replaceable.

Edison Glow Plugs are standard equipment on all Waukesha Comet Diesel engines.

NOTED DIESEL DESIGNER VISITS AMERICA

J. H. PITCHFORD, the Diesel specialist and assistant to Mr. H. R. Ricardo of Ricardo & Company, Research and Consulting Engineers of Shoreham, England, is visiting America, and consulting with the engineers and research staff of the Waukesha Motor Company and other licensees under the Ricardo patents for Diesel engines. Mr. Pitchford has been associated with the Ricardo Laboratories for ten years and has devoted the entire time to the research and development of the high speed oil engine.

"It seems surprising to me," said Mr. Pitchford, "that with the magnificent facilities everywhere in America and the very advanced developments in the petrol motor car and the petrol engine that relatively little, so far as I can discover, has been done with the Diesel engine in America. Of course, the Diesel has come in for a great share of publicity lately with the remarkable performance of some of the streamlined Diesel powered railway trains, but the opportunities for these spectacular perform-

ances are relatively few compared with the tremendous field for the practical application of the Diesel engine to motor coach and highway transport units. In England alone there are over six thousand Diesel engine buses and lorries, and even though the price of Diesel fuel and petrol is the same, there is a 50 per cent saving in fuel costs possible because of the greater mileage per gallon of Diesel fuel."

He further stated that the London Passenger Transport Board which is a government bureau supreme over all London transport lines, and operates a fleet of more than four thousand motor coaches — more than five times as many as serve the city of Chicago — after using 850 Diesel buses for the past several years has announced that all future contracts for new vehicles will be for oil-burning Diesel equipment.

"The experience of the London Transport with respect to Diesel operation," said Mr. Pitchford, "has been followed closely by Ricardo & Company because 98 per cent of their Diesel equipment is built under the Comet patents owned by my Company. At the present time, the maintenance of these Diesel powered vehicles is strictly comparable with their gasoline powered units and now that their operation has become standardized the actual stoppages in service due to engine failures are fewer in relation to the number of buses than with petrol operation. Congested traffic conditions and narrow streets make the complete absence of smoke and smell absolutely essential, and the police control in this respect is very severe. When Diesel engines are operated under such close police regulations, it would be natural to expect high maintenance costs because of the necessity for perfect conditions for the accurate control of combustion. Actually, in the case of the Ricardo Comet type engine, 50,000 miles of urban traffic between major overhauls is the established practice.

"There are now twenty-seven licensees of Ricardo Diesel patents distributed all over Europe building Comet Diesel engines ranging in size from 26 cubic inches to nearly a thousand, operating at speeds from 800 rpm. to 3,800 rpm. The engines built in America by the Waukesha Motor Company have all of the best features used by our European licensees."

It is said that regular visits are planned so that at six-month intervals either a representative of Ricardo & Company will be in this country, or one of the Waukesha Motor Company's staff of engineers will visit the Ricardo Laboratories in England.

RECENT INSTALLATION OF MARINE EMERGENCY LIGHT SETS

MEETING the requirements of the 2nd Supplement of the Rules of the Bureau of Navigation and Steamboat Inspection, the Standard Fruit and Steamship Company of New Orleans announce the recent installation of emergency lighting units on seven ships of their fleet.

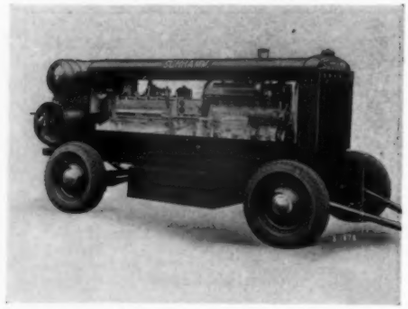
Installations were made on the S.S. *Amapala*, S.S. *Atlantida*, S.S. *Contessa*, S.S. *Cefalu*, S.S. *Gatun*, S.S. *Granada* and S.S. *Morazan*. The units consist of a single cylinder 5 x 7 Hill Diesel engine, direct connected to a 5 kw., 125 Volt Marble Card D.C. marine type generator. The Diesel engine and generator are mounted together on a rugged cast iron subbase. Radiator and fan for the supply of cooling water to the engine are mounted between the engine and generator, thus making the unit compact, self-contained and easily serviced.

The standard Hill full Diesel which operates the unit is of the cold starting, solid injection type and is equipped with a 12-volt electric starting mechanism which consists of starting motor, starting battery and generator for same.

Outstanding features of this Diesel which operates at 720 rpm., are water cooled exhaust manifold, dry sump pressure type lubricating system which eliminates all external oiling devices, automatic governor for the control of speed variations from no load to full load within 5 per cent, extra large hand-hole plates in the upper base through which all bearings may be adjusted and piston and connecting rod assemblies removed without disturbing base or cylinders. The construction of the entire engine has been generally simplified to reduce weight, vibration and repairs.

It is with deep regret that DIESEL PROGRESS notes the passing of Hiram Percy Maxim. The Diesel industry was but one of many fields of business in which Mr. Maxim's inventive genius was felt and to which he made such worthwhile contributions.

The Sales Department of Maxim Silencer Company has been transferred to their New York office and will be under the direct supervision of Frank L. Orr, General Sales Manager. Arrangements have been completed for handling the mid-west sales and service through Mr. R. F. McGill of the Diesel Plants Specialties Company, Chicago.



NEW DIESEL COMPRESSOR OF 50% LESS WEIGHT

AN announcement by Schramm, Inc., of a complete new line of portable compressors, to be known as the "Utility" design, has been introduced by the construction industry as an outstanding contribution to the cause of portability and light weight.

The design of these "Utility" compressors also establishes a new precedent by operating through direct drive from either gasoline or Diesel engine at approximately 1,200 rpm. The compressor unit is six cylinder, of small bore and stroke and light weight reciprocating parts. Because of the light weight castings which can be used for this design, the manufacturer claims a saving in weight of 50 per cent or more over former types of portable compressors.

Other features of design include mechanical intake valve action – another innovation in compressor design. This valve action assures perfect timing of air entering pistons and at the same time allows full area of compressor head to be devoted to discharge valve which is said to out-perform any other valve sixteen to one because of the larger valve area used and the reduced amount of valve action per square inch.

The Schramm "Utility" compressors also use a full force feed lubricating system which is a guarantee of long wear. Unloading is controlled by air pressure regulating the action of unloading valves.

These compressors are built in four sizes with actual air deliveries of 105, 210, 315 and 420 cubic feet free air per minute at 100 pounds pressure. They are offered in a complete assortment of portable running gears.

These "Utility" compressors can be secured with the latest type Buda "Lanova" Diesel engine operating at maximum efficiency of speed employed by the manufacturer.

CASE HISTORIES OF ECONOMY

EAST and West, North and South, throughout the entire United States, industries of all kinds are discovering in the Diesel engine the solution to their problem of reducing operating costs.

The adaption of the Diesel is almost unlimited for producing dependable yet inexpensive power. The two instances cited below are widely separated geographically as well as in the nature of their business, yet serve as representative conditions in which Diesel engines are proving their superiority beyond the shadow of a doubt.

Diesels Reduce Power Costs 72%

In 1904 the Lufkin Ice Co., Lufkin, Texas, started in business with a 20-ton plant. Business grew; the plant grew; power bills grew. When, in 1934, the company found itself operating a 60-ton plant and a 65,000 cubic foot cold storage, its purchased current was costing 73¢ per ton of ice.

After a thorough investigation, the owners installed their own power plant — two Fairbanks-Morse 140 hp. Model 32 Diesels, each belted to an ammonia compressor and an alternator with direct connected exciter.

Result: in the first month's operation, power costs dropped to 20.2¢ per ton of ice, a saving of 52.8¢ or over 72 per cent. Exact figures:

	June, 1933 Purchased current	*June, 1934 Diesel power*
Power cost	$494.00	$258.45
Operation	509 hours	720 hours
Production	677 tons	1,276 tons
Current	73¢ ton	20.2¢ ton

Dairy Farm Diesel

The Martin Century Dairy Farm, near Lansdale, Pa., installed a Fairbanks-Morse 40 hp. Model 36-4½ Diesel engine connected through reduction gears to a 6 x 6 York compressor to prove whether Diesel operation could save money over previous power costs.

Running 24 hours a day for seven days a week, the fuel and lubricating cost is approximately $17.40 per week. Figuring maintenance conservatively at $2.00 per rated hp. per year and insurance at 56¢ a week, the total cost of Diesel operation amounts to $19.50 per week.

Purchased current cost $80.50 per week at prevailing rates, showing a total weekly savings from Diesel operation of $61.00 or about $3,100 annually.

NEW DIESEL LINER FOR TRANS-ATLANTIC SERVICE

TENDERS have now been sent out by the Norske Amerika Line, Oslo, for a new combined passenger and freight liner for their Norway-New York trade, according to an item which appeared in the March issue of the *British Motor Ship*. Details concerning this new combined passenger and freight liner are given herewith.

Nothing but Diesel engines will be considered for propulsion. The principal dimensions proposed are as follows:

Length overall	about 558 ft.
Length on waterline 26 ft. draft	about 542 ft.
Length b.p.	525 ft.
Breadth moulded	72 ft.
Depth to "D" deck (upper deck)	37 ft. 6 in.
Draft loaded	26 ft.

Is is possible that the dimensions may be modified after the model has been in the experimental tank. We believe the speed will be in the neighborhood of 18 to 20 knots.

The vessel will be a three-class ship with accommodation for one hundred and fifty cabin passengers, two hundred and fifty tourist and four hundred third-class passengers. Many of the cabin-class cabins will have private baths, and there will be several one-passenger cabins. A very considerable area on deck will be provided for sport and entertainment, and there will be a swimming pool. Everything will be done to make the ship as seaworthy and fireproof as possible, also modern and tasteful in the decoration in every respect.

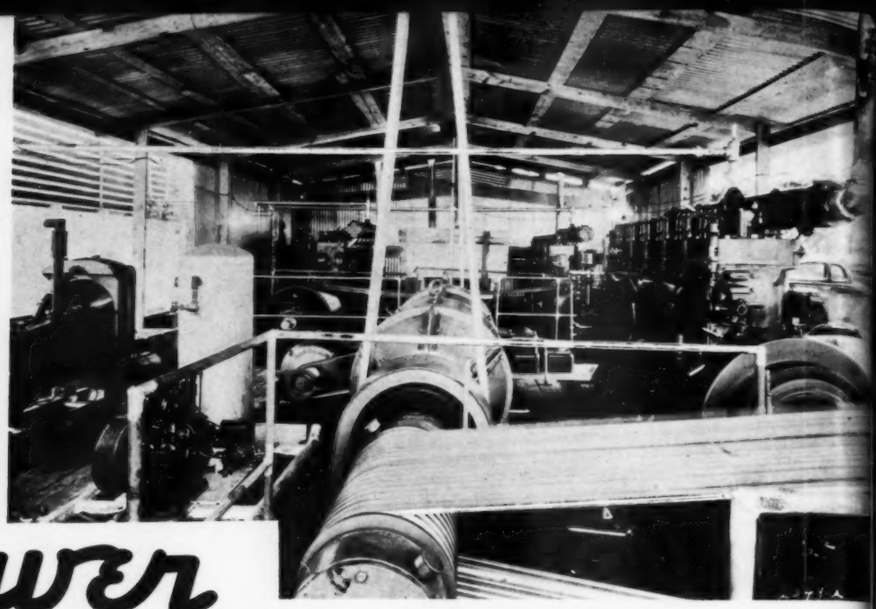
Four different propelling systems will be considered.

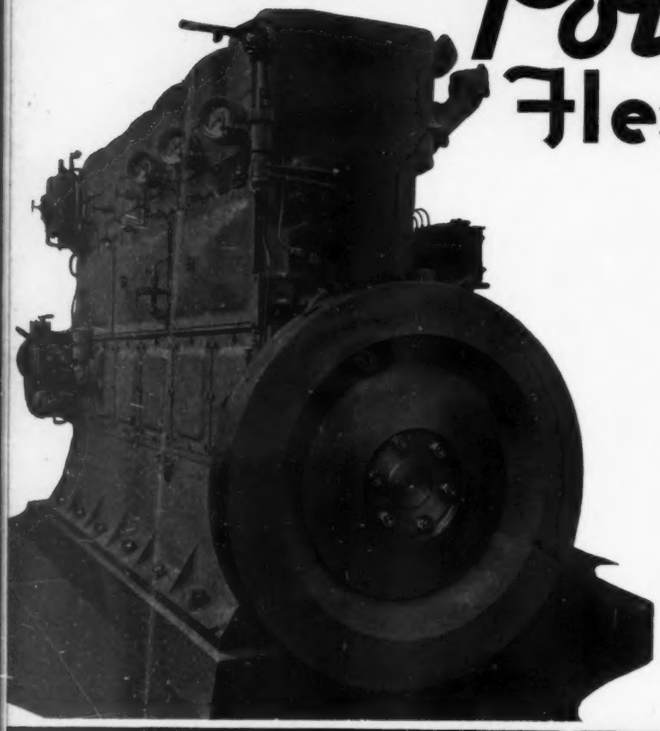
1. B & W double-acting 2-stroke engines.
2. Sulzer single-acting 2-stroke engines.
3. High-speed M.A.N. 2-stroke double-acting Diesel engines in which each pair of engines is coupled to the propeller shaft through a Vulcan coupling.

It is hoped that it will be possible to have this combined passenger and freight liner ready for the 1938 season.

The two large transatlantic liners owned by the Norske Amerika Line are the *Stavangerfjord* and the *Bergensfjord*. The first named is twenty-three and the latter twenty years old. And again it is brought home to the American public that all countries abroad are building Diesel powered vessels – but not the U. S. A.

Three ATLAS DIESELS Power Flexible Electric Rig

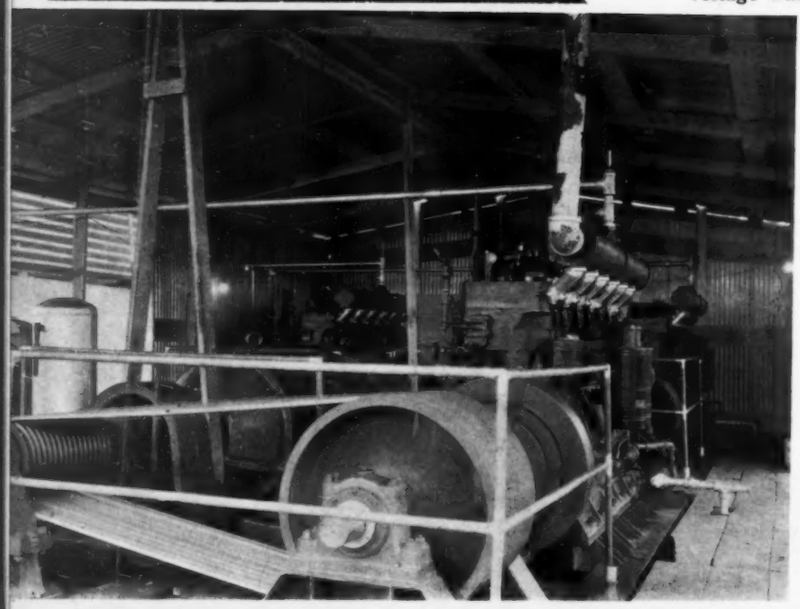




THE Atlas Diesel Electric Drilling Rig shown here, and said to be most powerful and flexible yet put on the market, is owned by the Noble Drilling Company and drilled its first hole near Ardmore, Oklahoma.

Three 240 H.P. Atlas Imperial Drilling Diesels of the enclosed type, developing their rated horsepower at 514 R.P.M., are V belt connected to one 150 KW and one 240 KW, direct current, 350 volt Allis-Chalmers generators turning at 1200 R.P.M. Two separately driven 25 KW exciters are used, one V belt connected to the main generator shaft, the other driven by a gasoline engine, the arrangement providing light and auxiliary power when rigging up and during down time on the main plant. The auxiliary generating unit is also used to start the engines electrically by means of a special winding in each generator.

The drilling motor is an Allis-Chalmers developing 400 H.P. at 1,000 R.P.M. It is direct connected to a Falk reduction gear which is connected to the drawworks by roller chain. The two mud pumps are driven by 225 H.P. motors. The generators are differential compound wound with separately excited field winding, and a series winding differentially connected to the shunt winding, which gives a drooping voltage when the motor torque increases and a rising voltage when the motor torque decreases. This characteristic is equivalent to an infinite number of automatically changing gear ratios between the engines and the drawworks, permitting the motor to accelerate and hoist the maximum loads without stalling the engines.



The flexibility of this rig cannot be duplicated by steam or any other mechanical drive system, where the driller is continually in doubt as to what gear ratio to use. This doubt results in loss of time and subjects the entire rig to excessive strains which result in breakage and attendant down time.

Besides its great flexibility this arrangement is also very economical. It eliminates the water problem incident to an undeveloped area, and it is cheaper to use a small amount of fuel oil than large volumes of high pressure gas. May we tell you more about this rig or about Diesel drilling in general? Your inquiries are solicited and given prompt attention.

ATLAS IMPERIAL DIESEL ENGINE CO.
Oakland, California • Mattoon, Illinois

ATLAS IMPERIAL

FIRST FIRST

HARD FACTS ON THE SHOW-DOWN

At Sutherland, Neb., a "Caterpillar" Diesel Power Unit pumps 350 gallons of water a minute from a 185-foot well through a 6-inch main to a dam 2½ miles away. Working night and day, it has operated more than 5000 hours without repairs—at a fuel and lubricating cost of only 12½ cents per hour! "Caterpillar" Diesel power is available for all kinds of work—as Engines or as Complete Power Units, with power rating from 44 to 160 maximum brake horsepower.

FIRST FOR LOW COSTS! FIRST FOR DEPENDABILITY!

Power users in scores of fields are choosing "Caterpillar" Diesel power today. It has the flexibility to handle widely varying loads with efficiency, the stamina to work long hours without interruptions. And its operating records prove it first choice for low costs and dependability: Shaft power at a fraction of ordinary costs—generated current at around one cent per K.W.H.—and low up-keep costs to match. Judged by output or by operating figures, it's the SHOW-DOWN! Caterpillar Tractor Co., Peoria, Ill., U. S. A.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL

A **NEW** *switcher powered with a* **COOPER-BESSEMER DIESEL**

HERE is a 57-ton Diesel electric switching locomotive which was designed and built especially for the East Erie Connecting Railroad.

Since the purpose of a Diesel electric switcher is to cut operating costs and increase available operating hours, the choice of the Diesel engine is most important. In this case a Cooper-Bessemer 275 B. H. P. Diesel furnishes the power.

Cooper-Bessemer locomotive Diesels have a great many features which make them especially adaptable to switching service. Your inquiries for complete switching locomotives should be addressed to the Home Office at Mt. Vernon, Ohio, or to the Eastern Locomotive Sales Office at 25 West 43rd Street, New York City.

THE COOPER - BESSEMER CORPORATION

Mt. Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd St., New York City | Mills Bldg., Washington, D. C. | 640 East 61st St., Los Angeles, Calif. | 201 E. 1st St., Tulsa, Oklahoma | 631 Spring St., Shreveport, La. | 53 Duncan St., Gloucester, Mass. | Magnolia Bldg., Dallas, Texas | Esperson Bldg., Houston, Texas

Gas and Power Equipment Company, Birmingham, Alabama